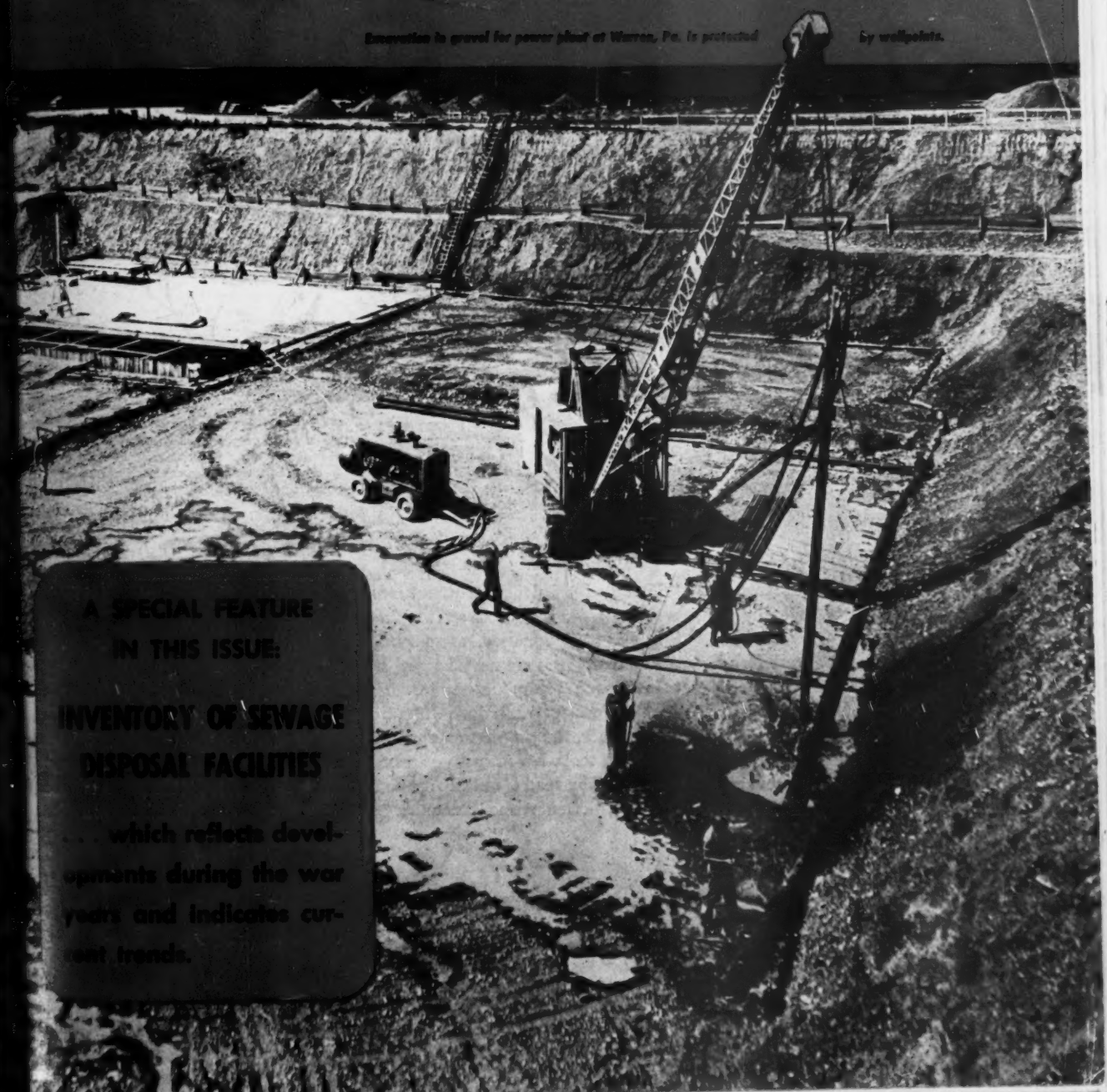
ENGINEERING NEWS-RECORD

NOVEMBER 14, 1946

Excavation in gravel for power plant at Warren, Pa. is protected by wellpoints.



A SPECIAL FEATURE IN THIS ISSUE:

INVENTORY OF SEWAGE DISPOSAL FACILITIES

. . . which reflects developments during the war years and indicates current trends.

1 *Original ARMCO Multi Plate installation—13¼ feet in diameter and 75 feet long.*

2 *This is what happened when a sudden flood washed out the road. The ARMCO Multi Plate structure was intact but was replaced by a bridge with greater flood capacity.*

3 *Making little bridges out of a big bridge was easy with ARMCO Multi Plate. Sections from the original structure were used in building this one. The same mitering was used at the ends without recutting. Two other arches, 7 feet in span and 40 feet long, were also constructed and enough plates were left for still another small bridge when needed.*

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Volume 137 • Number 20 — November 14, 1946

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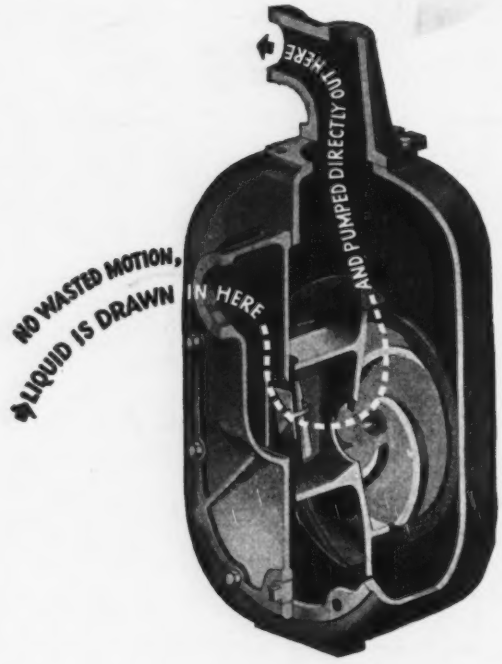
Marlow Pumps Do An Honest Day's Pumping!



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Construction Trends

Proposed Construction Totals $33,658,728,000

Proposed engineering construction in the amount of $6,656,806,000, recorded during the first nine months of 1946, brought the measured backlog of all proposed construction recorded by *Engineering News-Record* from January 1943 through September 1946 to the total of $33,658,728,000. This backlog remained after $981,-883,000 of proposed work advanced to active status, and became a part of the contract awards totalling $4,083,-161,000 during the first three-quarters of 1946.

Proposed projects included in the backlog in order of size are: earthwork, irrigation and drainage, $7,501,-733,000; public buildings, $6,957,347,000; unclassified construction, $5,734,050,000; highways, $4,052,229,000; commercial buildings, $3,070,294,000; industrial buildings, $2,147,291,000; sewerage, $1,882,091,000; bridges, $1,229,707,000 and waterworks, $1,083,986,000.

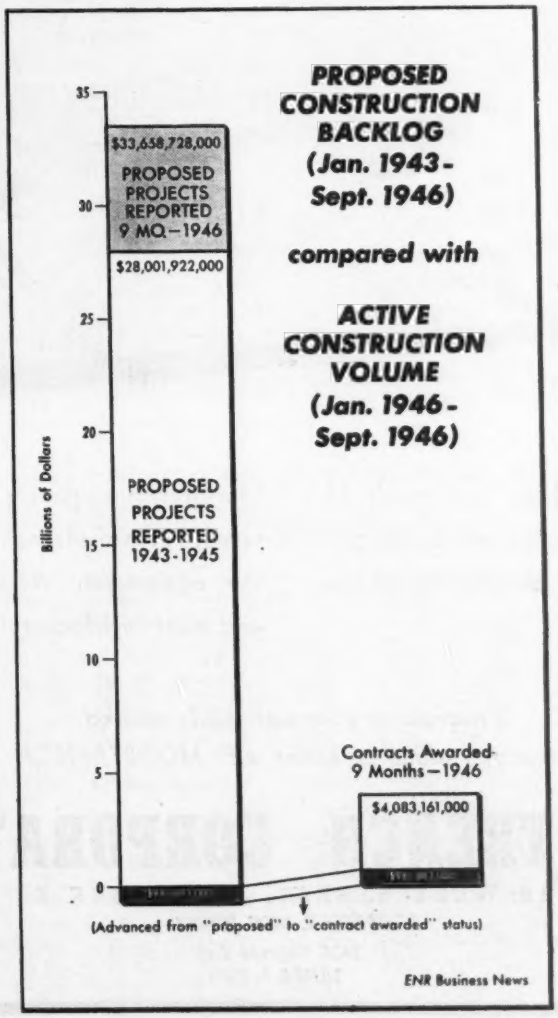
Construction projects proposed during the first nine months of this year account for 20 percent of the total construction backlog. In the classified construction groups, 1946 proposed industrial buildings and commercial buildings have shown the greatest rate of gain—each comprising 38 percent of its backlog. The ratios of construction work proposed during the January-September 1946 period to the total backlogs for the remaining classifications are less than the average of 20 percent; waterworks, 19 percent; sewerage, 18 percent; unclassified construction, 17 percent; public buildings, 17 percent; earthwork, irrigation, and drainage, 8 percent; highways, 8 percent; and bridges, only 7 percent.

During the nine months of 1946, only 3 percent of the construction projects listed in the backlog advanced to active status. Industrial buildings and commercial buildings again led the advance—14 percent of industrial buildings projects and 8 percent of commercial buildings projects were awarded. Other awards from the backlog were waterworks, 3 percent; unclassified construction, 2 percent; public buildings, 2 percent; highways, 1 per cent; sewerage, 1 percent; bridges, 1 percent; and earthwork, irrigation, and drainage, 1 percent.

Projects which advanced to active status total $981,-883,000. Included in this total are industrial buildings, $339,657,000; commercial buildings, $260,218,000; public buildings, $106,090,000; unclassified construction, $96,147,000; highways, $61,376,000; earthwork, irrigation, and drainage, $45,462,000; waterworks, $30,759,-000; sewerage, $27,146,000; and bridges, $15,028,000.

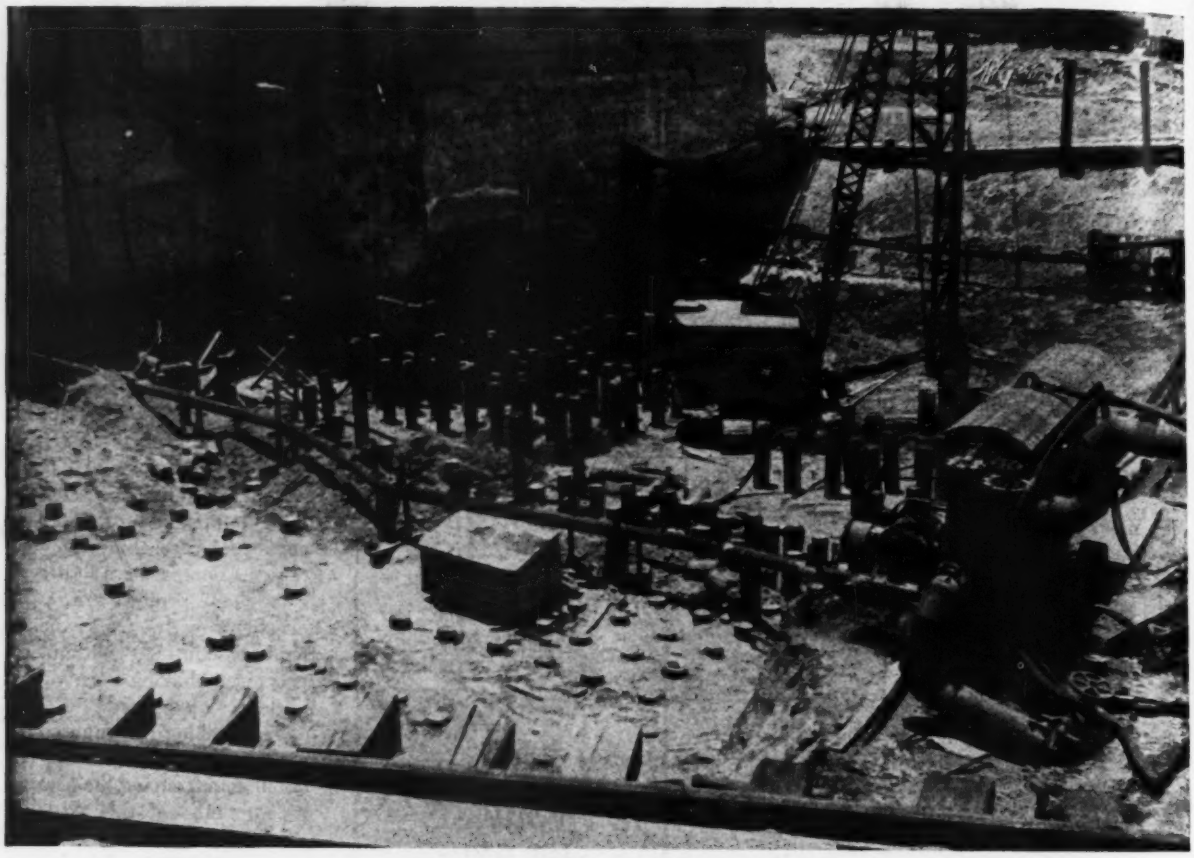
Contracts awarded from January through September, 1946 totalled $4,083,161,000. Backlog projects which moved to active status during this period, $981,-883,000, contributed only 24 percent to this contract total. The proposed construction backlog continues a conservative figure since many projects are reported directly from the field as contracts without previously having been reported as "proposed."

The backlog of proposed construction increased $6,-656,806,000 during the first nine months of this year, compared to a gain of $7,986,269,000 in the nine months of 1945. Projects moving out of the backlog into contract status totalled $981,883,000 this year, compared to $408,793,000 last year. However, total contracts awarded in the nine months of 1946 were $4,083,161,000, while the nine months of 1945 recorded a total of only $1,-496,000,000. The reserve of proposed projects, therefore, has increased less in 1946 than in 1945. However, since many contracts are never listed as "proposed" projects, the huge construction backlog of $33,658,728,000 is enough to insure a heavy sustained construction program.



"Another perfect job—"

reports our demonstrator on this power plant addition in Texas.



Difficult soil conditions (clay and sand) fifteen feet of water, an adjacent building — necessitated very careful dewatering of this work.

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New Construction Volume in October

Civil engineering construction volume in continental United States totals $488,457,000 for October, an average of $97,691,000 for each of the five weeks of the month. This average is 5 percent above the average for September, and is 63 percent above the average of October 1945, according to *Engineering News-Record*.

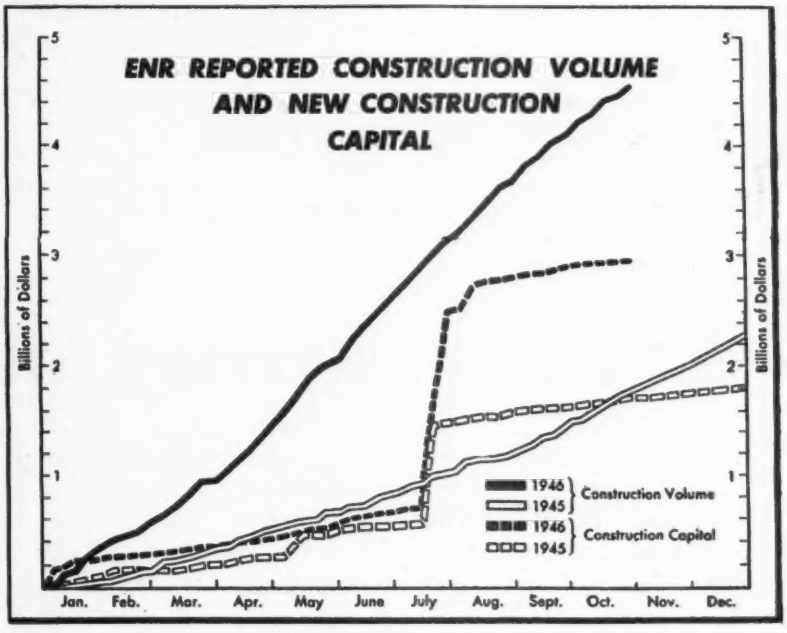
Private construction for October on a weekly average basis is 2 percent above last month, but 31 percent greater than October, 1945. Public construction is 9 percent above last month and 156 percent above last October. State and municipal construction, while 20 percent above last month, is 233 percent above the average for October, 1945. Federal construction, down 39 percent from last month, is 64 percent below October, 1945.

Weekly averages in the various classes of construction for October, 1946 compared with September, show gains in highways of 6 percent; public buildings, 53 percent; industrial buildings, 10 percent; commercial buildings, 20 percent; private bridges, 5 percent; waterworks, 51 percent; sewerage, 59 percent; and public unclassified, 97 percent; losses in public bridges, 28 percent; earthwork and drainage, 75 percent; and private unclassified, 81 percent.

Geographically, two sections show gains in October, 1946 over September—Middle Atlantic, 41 percent; and West of Mississippi, 37 percent. New England dropped 23 percent below September; South, 8 percent; Middle West, 23 percent; and Far West, 19 percent.

Four sections made gains in October over October, 1945 — New England, 124 percent; Middle Atlantic, 87 percent; South, 616 percent; and West of Mississippi, 69 percent. Middle West dropped 12 percent below last year, and Far West, 14 percent.

New capital for construction purposes for the five weeks of October, 1946 totals $113,962,000. On cumulative basis, new construction capital in 1946 totals $2,954,108,000, 72 percent greater than the 1945 ten-month total of $1,714,499,000.



ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—OCTOBER, 1946

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs — Waterworks, excavation, drainage and irrigation,* $22,500; *other public works,* $40,000; *industrial buildings,* $55,000; *other buildings,* $205,000

Five Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States — October	United States — Ten Months 1946	United States — Ten Months 1945	Canada
Public Works										
Waterworks	266	939	929	11,370	2,565	1,082	17,151	95,558	45,335	396
Sewerage	324	2,296	2,323	11,227	1,370	1,564	19,104	96,483	28,333	198
Bridges, public	1,117	2,059	2,293	1,241	1,945	1,252	9,907	113,107	29,622	.....
Earthwork and waterways	103	1,559	303	69	3,844	1,288	7,166	319,902	45,223	268
Streets and roads	3,450	18,911	20,854	7,190	21,821	6,798	79,024	681,026	187,009	1,144
Buildings, public	9,163	27,082	3,919	2,649	5,272	1,033	49,118	342,683	428,073	5,527
Unclassified, public	.....	11,260	590	1,555	751	390	14,546	146,223	232,148	409
Total public	14,423	64,106	31,211	35,301	37,568	13,407	196,016	1,794,982	995,743	7,942
Federal government (incl. in above classifications)	6,977	1,665	1,207	102	5,238	3,022	18,211	558,328	694,467	.....
Private										
Bridges, private	.....	40	.....	145	146	.....	331	2,092	3,981	.....
Industrial buildings	2,459	7,265	42,154	11,539	60,558	18,822	142,797	940,313	437,649	7,935
Commercial buildings	8,889	49,642	29,248	17,207	10,848	24,909	140,743	1,661,240	205,062	6,710
Unclassified, private	320	455	960	281	5,630	924	8,570	172,991	93,255	590
Total private	11,668	57,402	72,362	29,172	77,182	44,655	292,441	2,776,636	739,947	15,235
Total Engineering Construction:										
October, 1946 — 5 weeks	26,091	121,508	103,573	64,473	114,750	58,062	488,457	.....	.....	23,177
September, 1946 — 4 weeks	27,263	68,866	90,078	66,982	66,820	53,047	373,056	.....	.....	24,633
October, 1945 — 4 weeks	9,302	52,102	11,570	58,310	54,284	53,868	239,436	.....	.....	12,130
Ten Months — 1946	270,292	1,079,507	718,916	552,789	932,961	1,017,153	.....	4,571,618	.....	272,423
Ten Months — 1945	74,803	305,737	248,441	326,366	368,785	411,558	.....	.....	1,735,690	129,158

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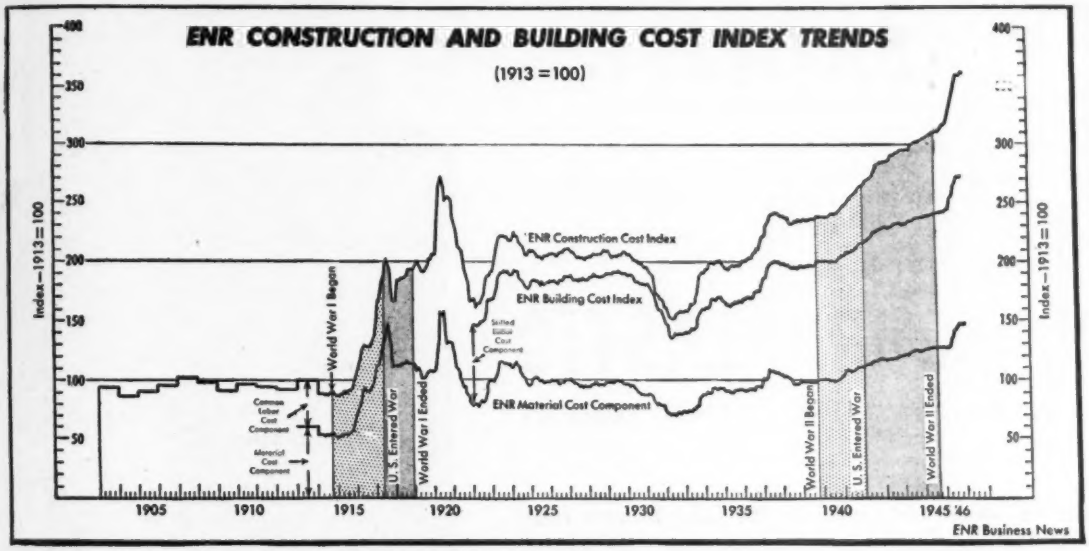
NOVEMBER CONSTRUCTION BUSINESS REPORT



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	October 1945 (4 wk.)	October 1946 (5 wk.)	% Change	Ten Months 1945 (43 wk.)	Ten Months 1946 (44 wk.)	% Change
Total U. S. Construction	$239,436	$488,457	+104	$1,735,690	$4,571,618	+163
Private Construction	178,183	292,441	+64	739,947	2,776,636	+275
Public Construction	61,253	196,016	+220	995,743	1,794,982	+80
Federal	18,559	18,211	−2	694,467	558,328	−20
E N R Construction Volume Index, 1913 = 100	167	233	+40	114	263	+131
Total New Productive Capital	$65,263	$113,962	+74	$1,714,499	$2,954,108	+72
Private Investment	65,263	113,962	+74	501,001	1,056,126	+111
Federal (non-federal work)	.....	.....	.....	163,600	225,000	+38
Federal (federal work)	.....	.....	.....	1,049,898	1,672,982	+59

ENR INDEX NUMBERS

Base — 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Nov., 1946	362.47	174.24	273.71	147.96	...	...
Oct., 1946	360.94	173.50	272.74	147.43	233	102
Sept., 1946	360.19	173.14	272.04	147.06	223	98
Aug., 1946	361.37	173.71	271.98	147.02	258	113
July, 1946	353.89	170.11	266.13	143.86	327	144
June, 1946	347.91	167.24	264.16	142.80	344	151
May, 1946	339.69	163.29	257.25	139.06	284	125
April, 1946	334.59	160.83	254.37	137.50	340	149
Mar., 1946	323.83	155.66	245.41	132.66	256	112
Feb., 1946	319.52	153.59	243.94	131.86	167	73
Jan., 1946	316.32	152.05	242.23	130.94	189	83
Dec., 1945	313.48	150.69	240.82	130.18	163	71
Nov., 1945	309.28	148.67	240.55	130.00	173	76
Oct., 1945	309.28	148.67	240.35	129.93	167	73
1945 (Av.)	307.74	147.93	239.14	129.27	123	54
1944 (Av.)	298.63	143.39	234.73	126.89	95	42
1943 (Av.)	289.95	139.38	228.75	123.66	176	77
1942 (Av.)	276.31	132.82	222.39	120.22	553	243

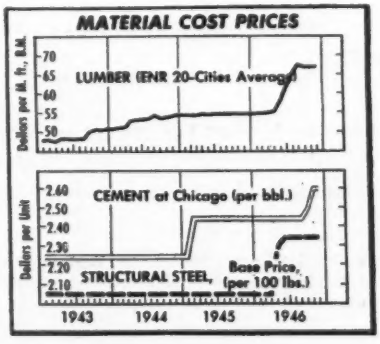
CONSTRUCTION COST . . . . WAGE RATES . . . . MATERIAL PRICES

1913 = 100	November 1945	November 1946	% Change	Change October to November 1945 Oct.	1945 Nov.	1945 %	1946 Oct.	1946 Nov.	1946 %
E N R Constr. Cost Index†	309.28	362.47	+17.20	309.28	309.28	0	360.94	362.47	+0.42
E N R Building Cost Index†	240.55	273.71	+13.79	240.35	240.55	+0.1	272.74	273.71	+0.36

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$0.917	$1.078	+17.56	$0.917	$0.917	0	$1.073	$1.078	+0.47
Skilled Labor (Av.3 Trades)	1.677	1.855	+10.61	1.674	1.677	+0.2	1.847	1.855	+0.43
Bricklayers	1.772	1.968	+11.06	1.770	1.772	+0.2	1.962	1.968	+0.31
Structural Ironworkers	1.729	1.865	+7.87	1.727	1.729	+0.2	1.860	1.865	+0.27
Carpenters	1.530	1.730	+13.07	1.525	1.530	+0.3	1.725	1.730	+0.29
Cement, per barrel	2.76	3.112	+12.75	2.76	2.76	0	3.106	3.112	+0.19
Reinforcing Steel, cwt.	2.79	3.370	+20.79	2.79	2.79	0	3.370	3.370	0
Structural Steel, base	2.10	2.350	+11.90	2.10	2.10	0	2.350	2.350	0
Sand, per ton	1.24	1.517	+22.34	1.24	1.24	0	1.501	1.517	+1.07
Lumber, 2x4 Fir, per M ft.	55.63	69.780	+25.44	55.63	55.63	0	69.780	69.780	0
Lumber, 2x4 Pine, per M ft.	53.84	64.311	+19.45	53.84	53.84	0	63.418	64.311	+1.41
Common brick, per M	19.58	22.225	+13.51	19.08	19.58	+3.0	22.225	22.225	0
Ready-mixed concrete, c.y.	7.63	8.323	+9.08	7.63	7.63	0	8.315	8.323	+0.10
Struct. clay tile, 3x12x12	86.33	98.379	+13.96	85.07	86.33	+2.0	98.232	98.379	+0.15



MATERIAL SHIPMENTS . . . BUILDING PERMITS

	October 1945	October 1946	% Change	September 1946	% Change September to October
Steel (% operating Capacity) A.I.S.I.	71.2	90.2	+27	88.5	+ 2

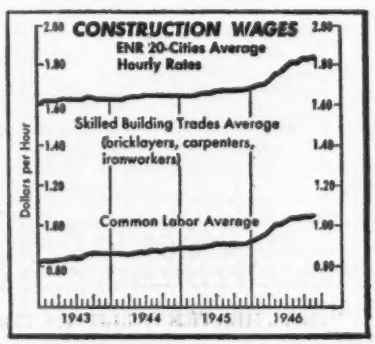
	August 1945	August 1946	% Change	Eight Months 1945	Eight Months 1946	% Change
Cement, thous. bbl. U.S.B. of Mines	11,467	17,955	+57	65,432	108,165	+65

	September 1945	September 1946	% Change	Nine Months 1945	Nine Months 1946	% Change
Fabricated Structural Steel, tons, A.I.S.C.	53,686	135,835	+153	515,479	1,073,085	+108
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$121,495	$176,492	+45	$728,791	$2,079,056	+185

COST OF LIVING INDEX . . . . EMPLOYMENT

	September 1945	September 1946	% Change	August 1946	% Change August to September
Consumers' Price Index, B L S	128.9	145.9	+13.2	143.7	+1.5
Rent (Housing) Index, B L S	108.3	108.8	+05	108.7	+0.1

	October 1945	October 1946	% Change	September 1946	% Change September to October
Const. Employment (est.), thous., B L S	1,175	2,246	+91.1	2,296	−2.2
Private Const. Employ. (est.), thous., B L S	939	1,803	+92.0	1,846	−2.3



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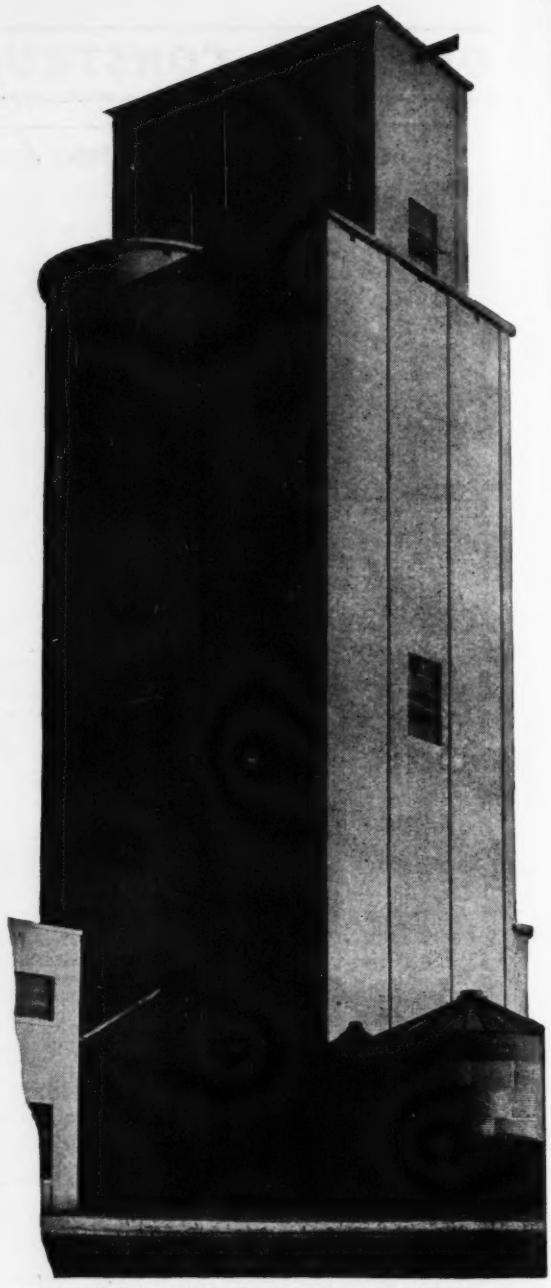

ELEVATOR built with slip-forms for Janesville Mills, Inc., Janesville, Wis. Duraplastic cement used. Engineers, Chalmers and Borton, Hutchinson, Kansas; Contractor, Ford Construction Co., Janesville.

ENR-D 44

AIR BUBBLES IN CONCRETE . . . MAKE IT MORE DURABLE . . . AND MORE PLASTIC

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News of the Week

ENGINEERING NEWS-RECORD • NOVEMBER 14, 1946 • VOLUME 137 • NUMBER 20

Truman orders price control lifted from construction

Wages and material prices freed of regulation by President's action—Priorities, allocations, price and rent ceilings continue on housing

Under terms of a sweeping order issued by President Truman Nov. 9, the construction industry has emerged, at least partially, from almost four years of tight government control.

The president's order, which lifted price restrictions on every phase of the country's economy excepting housing, sugar and rice, specifically took construction materials prices and wages out of the sphere of regulation. It was a partial answer to the pleas of the construction industry, voiced by such organizations as the Associated General Contractors of America and many others, for permission to conduct their business on a free-economy basis.

However, as government offices closed down for an Armistice Day holiday Nov. 11, the situation as regards construction was still somewhat cloudy. While manufacturers of building materials and contractors were freed from restrictions as to prices and wages, the National Housing Agency announced that it would maintain priorities and allocations for channelling materials and equipment into housing, maintain limitations on non-residential construction, and continue to enforce the present ceilings of $10,000 on new homes and rental rates of $80 per month on new houses and apartments for veterans.

Premium payments to manufacturers of scarce materials, and guaranteed marketing plans for prefabricators also will remain in effect, NHA said.

In a statement commenting on his order, President Truman said that he believed that the nation's economy was in such condition that continuing of controls on some items and not on others would lead to "distortions" of production. Commenting on building materials, he added:

"I wish it were possible to keep effective price controls on building materials, in furtherance of the veterans' emergency housing program. . . . But price controls on building materials alone . . . would drive these materials away from housing and defeat the objectives of the program. The removal of . . . controls on building materials will obviously necessitate a change in the approach to some of the problems of the housing program. I have asked the housing expediter to report to me promptly in this regard."

Mr. Truman said that the removal of controls "leaves no basis or necessity" for continuation of wage controls—putting a halt to the codification and publication of approved area wage rates for the construction industry (*ENR* Oct. 17, vol. p. 488). Although wage controls thus are completely removed, employers in the building industry may still be subject to income tax penalties for any unlawful wage adjustments which took place previously.

The closing of government offices for the one-day holiday, and the comparative suddenness (despite the fact that such a move was expected) of the order, made it difficult early this week to gather official opinion as to the effect of the order.

However, the consensus of the construction industry, expressed also in an editorial published in this issue, appeared strongly in favor of the action. Only a week ago, representatives of the AGC, the U. S. Chamber of Commerce, the National Home Builders Association and the National Retail Lumber Dealers' Association, appearing before a housing conference called by the American Legion at Washington, made strong appeals for an end to control over the industry.

Most industry leaders look for an immediate rise in cost of materials, and then a gradual levelling off as a "buyers' market" prevails. An interesting sidelight on this situation (see page 87 this issue) is an analysis of *Engineering News-Record's* Construction Cost index, which shows that costs have remained virtually unchanged over the last four months.

Announce new wages in several localities

While the federal government was lifting all controls on wages paid to labor early this week, wage adjustments to city and private construction employees under former rulings were listed at many points. Included were:

Public works employees of the Village of Scarsdale, N. Y.—a suburb of New York City—were granted a $6 per week cost-of-living wage adjustment and a reduction of the work-week from 48 to 44 hours.

For Pennsylvania, the Wage Adjustment Board approved increased minimum wages to workers on state highway projects (*ENR* Aug. 22, vol. p. 217).

At Louisville, Ky., the WAB approved pay raises for an estimated 7,640 building construction workers, including 10 cents an hour for laborers; 12½ cents an hour for structural iron workers, pipefitters and plumbers, and 20 cents an hour for bricklayers.

Building materials men organize research agency

Representatives of 200 companies and associations engaged in the manufacture of building materials and equipment have formed a new fact-finding and economic research organization called the Building Products Institute.

Douglas Whitlock, formerly chairman of the advisory board of the Producers' Council, who was elected chairman, said, "The purpose of the institute is to assemble, analyze, and disseminate facts about the production of building materials and equipment and about the progress of construction, including housing.

"The institute also will analyze and make recommendations with respect to proposed legislation affecting the construction industry, and will cooperate with other branches of the industry in preparing recommendations to stimulate a maximum building volume."

The offices of the institute will be at 1756 K Street, N. W., Washington 6, D. C.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Construction—National Biscuit Co., has announced an $8,000,000 construction program consisting of new factories and alterations and additions to present ones in various sections of the United States. . . . The Jewish Hospital, *Philadelphia, Pa.*, plans a $1,000,000 nurses' home. . . . A $2,500,000 shopping and recreation development for *North Beverly, Mass.*, has been announced. . . . *Quincy, Ill.*, plans to erect an administration building, construct hangars and pave additional apron area at its municipal airport. . . . A new village, to be known as Bal Harbor, is being built at the north end of *Miami Beach, Fla.*, including a $1,750,000 hotel. . . . CPA has approved a $4,000,000 steam turbine generating plant for *Wilmington, Calif.* . . . A 1,300-student high school is being built at *Edmonton, Alta.* . . . Hercules Powder Co. has bought a 284-acre tract of land at *Wilmington, Del.*, for future expansion. . . . Plans for a $1,500,000 building and remodeling program have been announced by the Salem General Hospital, *Salem, Ore.* . . . A $1,000,000 brewery is being planned by Molson's Brewery Co., *Montreal, Que.* . . . The Southern Railway Co. is asking bids on a $1,000,000 diesel engine repair shop at *Chattanooga, Tenn.* . . . The University of Pennsylvania, *Philadelphia, Pa.*, has announced a $28,000,000 building and expansion program.

Housing—New premium payment regulations covering galvanized and carbon steel sheet, and millwork items, other than doors, will be issued this month by NHA. . . . McCloskey & Co., will build a $1,300,000 residential development at *Annapolis, Md.* . . . Atlas Builders, Inc., *Trenton, N. J.* have been awarded a $2,000,000 temporary housing contract by the N. J. Department of Economic Development. . . . Joseph Salvucci has begun a million dollar housing development in *West Philadelphia, Pa.* . . . Other Philadelphia developments are Fishman & Park, $1,000,000, and Rittenhouse Built Homes, Inc., $1,000,000. . . . Madway Engineering and Construction Co., *Ardmore, Pa.*, $3,000,000. . . . Harold F. Chadwick, *Dresher, Pa.*, $4,250,000.

Sewerage—*Peoria, Ill.*, is considering a storm sewer system in the Uplands area to cost about $285,000 and another for North Street to cost about $125,000. . . . *Wilmington, Del.*, will seek bids shortly for its Ninth Ward storm sewer project. . . . *Lehighton, Pa.*, has surveys under way for a sewer system and treatment plant to cost $500,000. . . . *Johnstown, Pa.*, has preliminary plans partly ready for a garbage incinerator and sewage disposal plant to cost $600,000.

Highways—Contracts of over $10,000,000 on 47 projects in 37 counties have been awarded under *Mississippi's* highway construction program. . . . The *Illinois* Division of Highways plans improvements costing about $1,500,000 on U. S. Route 30, the original Lincoln Highway. . . . A recent survey shows work under way or completed in 34 counties on 167 miles of highway in *Indiana.* . . . In October the *Texas* Highway Commission received highway project bids totalling $7,741,756.

Water Supply—Waterworks systems are being planned for *Molena, Milner* and *Meansville, Ga.*, federal funds being available for surveys. . . . Contracts have been awarded for completion of the waterworks expansion program at *Evansville, Ind.*, to cost about $1,250,000. . . . *Fairfield, Ill.*, has awarded a contract to F. A. Coon Construction Co., Chicago, for improvements and extensions on its waterworks and sewage systems at $405,279. . . . *Columbus, Ohio*, city council is studying a proposal for a water filtration system five miles southeast along Big Walnut Creek, which might produce 20 mgd. to supplement present supplies.

N. M. road officers resign in machine buying fight

Chairman Floyd Kennedy and Walter Berger of the New Mexico highway commission last week, turned in their resignations, charging that Gov. John J. Dempsey had "dictatorially" ordered cancellation of contracts and equipment purchases, "ignoring" the advice of the commission.

A letter of resignation from the two men accused the Governor of cancelling "a vast number of small state road contracts and equipment orders" early in October without consulting the commission.

The Governor, admitting that he had acted over the heads of the commission, said that the machinery orders concerned were those in which the contracted delivery date had passed. He said he believed it better business to stop the purchases, now that the weather prevented use of equipment for which delivery date had been a prime factor in the contract award.

"The use of much equipment is seasonal," the Governor pointed out. He said that snow plows, for example, were needed now if they could be delivered. "But I'm not going to see other new equipment, which can't be used now, sit out in the weather during the winter months.

The resigned commissioners, stating that only slightly over $300,000 had actually been invested in new equipment in the last four years, said that they could not believe it good business to cancel purchase orders for badly needed equipment at prices well under those that might be quoted at present.

***Anniversary**—E. A. Moritz, regional director for the Bureau of Reclamation's Region III, addresses visitors observing the tenth anniversary of production of power at Boulder Dam. An earlier speaker, Michael Straus, Commissioner of Reclamation, took advantage of the occasion to remark that 1947 will mark the "silver jubilee" of the failure of the seven Colorado Basin states to agree on allocation of the river's water.*

See halt in construction cost rise as index figures show levelling-off

Analysis of Engineering News-Record figures show four-month period of almost no gains in costs

A halt in the upward spiral of construction costs has appeared in an analysis of *Engineering News-Record's* Construction Cost Index which shows that this indicator has virtually levelled off over the past four months.

The *ENR* index reflects cost trends much more quickly than do any other such barometers in the field, since it reports current changes at the beginning of each month, where most other indexes lag from a month to several months.

After a steady rise since January of this year—of about 6 index points per month—the cost index reached 361.37 percent in August, fell to 360.19 in September, and by November had regained only 1.10 points, to reach a high of 362.47.

Using the year 1913 as a base of 100, the index is based on four major components—the costs of common labor, lumber, cement and steel—and does not reflect the factors of black market prices or undue work stoppages due to shortages or labor disputes.

However, statisticians pointed out that the apparent stabilization of the total figure is exactly parallel to stabilization of the components. All four, after reaching comparative highs in August, have held consistently in the same range. The labor component, which rose from 190 to 214 from January to August, gained only 1.6 points by November. Cement gained less than .9 points; steel remained unchanged over the four-month period, and lumber actually fell 1.2 percentage points in the same time.

Construction volume drops

An unusual feature of the cost levelling has been a drop in construction volume (*ENR* Oct. 31, vol. p. 568). Ordinarily, statisticians said, contract volume increases as costs go up, as builders hasten to get their jobs under contract as a hedge against further price rises. Actually, volume has dropped steadily since August.

On the cost side, there is one further factor that as yet cannot be appraised—the effect of removal of all price controls on the industry—announced Nov. 9 (see p. 85 this issue).

This journal's business news staff, commenting on the indications, pointed out that, for the moment at any rate, there is no parallel with the behavior of construction costs after World War I. In that period, costs reached a peak during the war—in 1917—and dropped very sharply within that year and in 1918. After an interval of about a year, prices again rose very sharply in 1920, reaching a peak in June of that year, and then fell steadily over a two year period, until 1922.

During the war years 1941-1945 prices rose steadily, but with no particularly sharp gradients, and did not begin a steep climb until 4 months after VJ day. They have gone up quite sharply since that time, until they reached the present 4-month plateau.

St. Louis gets low bid for airport work

The St. Louis Board of Public Service Oct. 29 received a low bid of $752,681 for the construction of a 4100-ft reinforced concrete 200-ft wide runway and connecting taxiway to be installed at Lambert-St. Louis Municipal Airport, Robertson, St. Louis County. The bid, submitted by Fred Weber, Jr., general contractor, St. Louis, was almost $220,000 under the $972,000 estimate made by the city engineers headed by Guy Brown, chief engineer. The second lowest bid submitted was $835,058 by the Koss Construction Co., Des Moines, Iowa, while the highest of the ten bids received was that of Stiers Bros. Construction Co., St. Louis, $1,108,834.

Mr. Brown in commenting on the low bid said that Weber apparently does not anticipate a further rise in construction costs of serious proportions, and perhaps expect to do the work in a much shorter time than the city engineers had estimated would be required.

Plan $5 million railroad facilities in Missouri

The Frisco Railroad plans expenditure of $5,000,000 for expansion of its shops, yards and terminals at Springfield, Mo. When completed, the new facilities, it is said, will save the company at least $400,000 in yearly operation and maintenance costs.

Yards will be enlarged to accommodate 3,000 cars. The new yard facilities will include 53 miles of new track, a new round-house, a machine shop, an employee restaurant, a 2-story office building, 4000-ton coal chute, oil storage tanks, power and water lines.

***Mobile Power**—Peacetime as well as wartime uses are being found for the two 6-car, railway-mounted, mobile power plants built for the Bureau of Yards and Docks during the past war. One of the plants (above) is now near Phoenix, Ariz., where severe droughts have crippled the local hydropower systems, and the other unit—based normally at Philadelphia—is being sent to Florida to supply power for the Navy's $70,000,000 berthing program for inactivated ships at Green Cove Springs. Plants consist of a boiler car, turbine car, switchgear car, transformer car, and two cars carrying miscellaneous equipment. Length of the train in transit is 634 feet.*

Miami Conservancy District clears debt after 33 years of operation

Taxpayers in famous pioneer flood-control district in Ohio have paid off $34 millions in bonds and have spent other millions for maintenance without recourse to either federal or state aid

The flood-control works built between 1914 and 1918 to protect the cities and farms in the Miami River valley in western Ohio are completely paid for, the board of directors of the Miami Conservancy District announced on Oct. 25. At the same time, scheduled assessments totaling about $5.5 millions were canceled, since the district has enough funds, set aside for contingencies that did not arise, to pay off the last bonds in the $33,890,910 issue, first maturities of which were paid 23 years ago. The entire cost of the district to date has been between $45 and $50 million, no part of which has been borne by state or federal appropriations.

Brought into being after the flood of March, 1913, devastated the valley, including the cities of Dayton, Hamilton, Middletown, Troy and Piqua among others, the Miami Conservancy District was the first one to be formed under the Conservancy Act passed by the Ohio legislature in 1914. The project itself made engineering history by its introduction of detention reservoir storage into flood-control practice and by the unusually thorough preliminary investigations upon which its design was based. It gained in historic fame by its operation as planned, by efficient management through the years and now by the fact that it has been completely paid for by the benefited residents themselves. The Ohio Conservancy Act served as the model for all other similar laws passed since, providing for the right of eminent domain, for raising money through local participation and for authorizing districts to enter into contracts with federal and state governments.

In announcing the district's freedom from debt, E. A. Deeds, president, who has headed the organization from the beginning, pointed out that maturing bonds must still be paid off in 1948 and 1949, but that from now on the only cost to taxpayers will be for improvement and maintenance to the five earth dams and reservoirs and to the levees and flood flow channels. The facilities of the Miami Conservancy District, which have protected one of the nation's rich industrial and agricultural valleys so effectively, were designed and built under the direction of Arthur E. Morgan as chief engineer, and benefited from the labors of many of America's most eminent civil engineers, among them Charles H. Paul, Daniel W. Mead, S. M. Woodward, K. C. Grant, O. N. Floyd, G. H. Matthes, G. B. Massey, C. A. Bock, John W. Alvord and Charles B. Burdick.

FPC begins hearings on Clark Hill project claims

The government to date has spent $1,021,000 on plans, development and construction of the multi-purpose project at Clark Hill, on the Savannah River north of Augusta, Ga., Army Engineers said last week as the Federal Power Commission began hearings on the application of a private power company for the right to build the $40,000,000 project.

The Savannah River Electric Co., an affiliate of the Georgia Power Co., several weeks ago announced it would ask for a license to construct the planned concrete masonry and rolled earth dam, and a powerhouse (*ENR* August 29, vol. p. 271).

Testifying before the FPC, Col. Paschal N. Strong, district engineer at Savannah, said that the $1,021,000 spent to date was a part of an appropriation of $5,000,000 authorized by Congress for the initial work on the project.

He declared that present commitments outstanding, including design (which is being done for the Army by Chas. T. Main, Inc.,) amount to $991,000. Taking of bids for construction is contingent upon funds being made available by "higher authority", Colonel Strong said, but the present schedule for bids is: West embankment, Nov. 1; diversion channel, Nov. 8; main dam, including concrete section, east embankment and power house substructure, Dec. 15; construction village, Jan. 22, 1947; and power house, April, 1948.

The hearings were held to receive testimony as to the jurisdiction of the FPC to grant Savannah River Electric Co. a license since the Congress subsequently authorized construction of the project by the Army Engineers. The utility received an FPC license in 1928 to construct the project but surrendered the license in 1932 because of unfavorable economic conditions.

J. Archer Turner dies, Turner Co. chairman

J. Archer Turner, 61, chairman of the board of directors of Turner Construction Co., New York, and its president from 1941 until last Oct. 1, died Nov. 1, in Brooklyn.

Mr. Turner was graduated from Swarthmore College, B. S. in engineering in 1905, and C.E. in 1911. After graduation from college he spent a year with the Pennsylvania Railroad and a year with Ransome & Smith in New York, and then became associated with the Turner Concrete Steel Co. of Philadelphia, which was merged in 1919 with the Turner Construction Co.

He was elected a director of the company June 3, 1931, and became vice-president in charge of the Philadelphia office July 1, 1931. He was elected chairman of the executive committee in 1937, went to New York in 1939 as executive vice-president and in 1941 was elected president to succeed his brother, Henry C. Turner, founder of

J. Archer Turner

the company. He continued as president until the retirement of the founder on Oct. 1, of this year, and was then chosen his successor as chairman (*ENR* Sept. 26, vol. p. 399). Mr. Turner was president of the company during the war period when it executed the largest volume of construction and management work in its history.

Mr. Turner was a member of the board of managers of Swarthmore College, and vice president at the time of his death, and chairman of its endowment campaign. He also served as treasurer of the college from 1931 to 1941. He was past president of the Swarthmore Alumni Society and Swarthmore Club of Philadelphia. He was also vice-president of the New York Building Congress and a trustee of the Provident Mutual Life Insurance Co. of Philadelphia.

Random Lines from an editor's notebook . . .

. . . . In which ENR's western editor reports on an unusual meeting where invited contractors and construction equipment manufacturers advise the Army on Garrison Dam

Answers to some questions that have been puzzling Col. W. W. Wanamaker and his staff in the Garrison District, USED, and a most promising precedent came out of discussions between Army Engineers and more than 80 representatives of the construction industry at Bismarck, N. D., recently.

Briefly, the group was invited to gather at Fort Lincoln to inspect the site of Garrison Dam (*ENR* June 13, vol. p. 920) and thresh out with the Army's engineers the problems to be encountered in planning the construction of what will be the world's largest rolled-fill embankment, containing 75,000,000 cu. yd. of compacted soil.

The prime question on Colonel Wanamaker's list concerned the advisability of starting construction in 1947 by award of a relatively small contract which might be financed out of funds available that year. The answer was, "Don't do it."

Three days were used to good purpose in a well-arranged program set up by the district staff. Invitations had been sent to some 35 firms in the contracting and equipment manufacturing fields. A snowstorm on the day for inspecting the site hampered the visibility but did not dampen the spirits of more than 70 who made the 75-mile trip north of Bismarck.

On the third day of the conference the group got down to the meat of the menu. Among the significant contributions of the discussion were these:

1. Let a complete contract for the entire embankment rather than try to initiate construction in 1947 with limited funds by a small-scale contract for perhaps 3,000,000 or 4,000,000 yd.

2. Include the outlet works in the embankment contract in order to centralize responsibility with one contractor for all construction related to river diversion and closure. The outlet works require 1,200,000 cu. yd. of concrete, and the Corps of Engineers had planned to include these structures in an overall contract for 2,000,000 cu. yd.

3. Give contractors a long estimating period (six months, if possible) between dates of advertising and bid closing to allow time for full study, financing and equipment delivery.

4. Let the contractor finance his own equipment purchases with provision in the contract for allowances on monthly estimates following delivery of equipment, the allowances to be worked off in succeeding estimates.

5. Classify materials such as lignite and limestone, which the contractor would be required to waste, as a separate item or items in the contract. Lignite comprises about 10 percent of the excavation, and limestone probably less than 1 percent. It is expected that the lignite can be mixed in fill layers in quantities up to 20 percent, but it occurs in the excavation in beds of various thickness, some of which range to 12 feet in depth, and these heavy veins will have to be wasted. Limestone has been mapped in thin lenticular formations, erratic in location, and their removal will present a problem in maintaining uninterrupted flow of acceptable material to the dam.

Machines by 1948

Representatives of several shovel and tractor-scraper manufacturers offered the opinion that equipment deliveries in adequate volume probably could be made in 1948 for starting a 6-year dam construction program.

One manufacturer of mechanical equipment for belt conveyor systems volunteered the information that an order placed today would take 18 to 24 months for delivery.

A slow-speed order recently put in force to reduce accidents with pneumatic-tired hauling equipment on one U. S. Engineer dam project cut travel speed to 15 mph. If the slow order should apply generally estimates for this kind of equipment on Garrison Dam would have to be revised sharply.

Except for river diversion through the outlet works and closure of the dam in the fifth year of construction, no rigid schedule of operations has been proposed. About 86,000,000 cu. yd. of excavation is required to furnish 75,000,000 cu. yd. of rolled fill for the embankment.

The proposed schedule calls for the following quantities to be placed in rolled embankment by years: (1) 4,500,000 yd.; (2) 9,000,000 yd.; (3) 14,750,000 yd.; (4) 17,000,000 yd.; (5) 16,500,000 yd.; (6) 12,500,000 yd. The fourth (peak) year would require about 20,000,000 cu. yd. of excavation and an average of 2,500,000 cu. yd. per month placed in embankment for the seven-month construction season, with about 4,000,000 cu. yd. placed in the peak month, or 175,000 cu. yd. per day for 25 working days under average conditions at the site.

Inspection trip

An important feature of the inspection trip was an exposed bank of typical Fort Union formation, the material from which the dam will be built. The formation contains fat clay, silty clay, sandy clay and lean clay, none of it with a clay content less than 30 percent. Its natural moisture content is close to optimum, and no addition or extraction of water is considered. A test embankment already constructed indicates that the material can be compacted to desired density in 9-in. base, 6-in. compacted layers with ten passes of a conventional tamping roller having 640-psi. pressure under the tooth contact area.

In concluding the meeting Colonel Wanamaker invited all present to send further suggestions to him. If time and circumstances permit, Colonel Wanamaker intends to hold another similar conference before the project is advertised for bid. . . . *V.B.S.*

***Cold Trip**—It was cold and snowing, but construction industry experts donned their safety jackets and made the crossing of the Missouri River on an Army barge-ferry to inspect the site of Garrison Dam, near Bismarck, N. D.*

Sewer battle catches L.A. in middle

Mayor Fletcher Bowron and 23 other members of the Los Angeles city council last week found themselves exactly in the middle of a two-edged court controversy over the city's proposed Hyperion sewage disposal plant.

On the one hand, Mayor Bowron and his councilmen were ordered to appear in Superior Court to show why they should not be found in contempt of court for delays in construction of the new sewage disposal plant.

On the other hand, two city taxpayers filed suit against the city to prevent construction of the proposed plant, on the ground that construction would prove too costly and would not clear up pollution on nearby beaches. The taxpayers asserted that money could be saved and the interests of sanitation served by integrating city and county disposal systems.

The show-cause order of the Superior Court was based on an affidavit by Judson A. Harmon, senior sanitary engineer of the State Department of Public Health, that the city officials had "willfully delayed construction of the sewer outfall and treatment plant in violation of a court order issued Feb. 1 (*ENR* Feb. 21, vol. p. 58).

Commenting on the court order, Mayor Bowron said: "The whole difficulty, insofar as delay is concerned, has been caused by changed conditions since the taking of testimony on which the judgment of the court was based. We worked as fast as possible under all the circumstances. We wanted to get that sewer treatment plant constructed so we resorted to no delaying tactics."

The mayor pointed out that no one could foresee the many strikes and disturbances that have retarded the progress of all types of construction and said that mounting costs have upset original estimates and have resulted in difficulties in financing the project.

The $3,500,000 contract for the construction of the 12-ft. diameter outfall 5,000 ft. in length is held by Guy Atkinson & Co., while $3,500,000 excavation work contracts are held by Peter Kiewit & Sons Co.

The city still has under consideration a proposal made earlier this year by Charles T. Leeds, A. M. Rawn and Franklin Thomas, engineers who were engaged to check upon the plans and specifications for the outfall. The report made by these engineers was read at a meeting attended by members of the city council and other Los Angeles city officials last July 22. At the time the report was submitted, contracts for much of the work had already been let, and the proposal took into consideration the commitments already made but recommended that the outfall be extended an additional 5,000 ft.

The report acknowledged that the extra 5,000 ft. would add $2,000,000 to the cost of the project, but estimated that it would save $10,000,000 in treatment plant construction and $400,000 annual operation expense. Last week, a spokesmen for the board of engineers estimated that the extra 5,000 ft. extension might save as much as $16,000,000 in view of developments subsequent to the report.

Army frowns on building dam at Sweet Home, Ore.

A system of earth-fill dams has been recommended by U. S. Army Engineers in place of the previously proposed Sweet Home Dam in the Willamette Valley of Western Oregon, according to Col. O. C. Walsh, Portland district engineer.

The proposed Sweet Home dam is "not now favorably considered" in view of the rapid development of the valley.

The new plan calls for the construction of flood control dams at Green Peter on the middle Santiam River, on Thomas Creek near Jordan and in Wiley Creek, southeast of Foster, together with an extensive system of levees. The cost of the three dams is estimated at $17,700,000.

CITY LENDS MONEY TO U. S.

The federal government, which has loaned many millions to municipalities in the past, is now going to accept a loan of $750,000 from the city of Cincinnati, Ohio.

That city will help the Army Engineers' in building a dam until they are relieved from restrictions imposed by the recent $130,000,000 limitation placed on flood control work for this fiscal year. The money will be used in connection with the Engineers' Mill Creek Dam project.

The War Department asked the Budget Bureau for authority to accept the loan and permission was granted.

It is expected that other cities may now follow this example since it is evident that such projects are not entirely blocked by the economy order, and Reconversion Director John R. Steelman has shown willingness to allow use of materials and labor for such purposes. The Louisville engineer district office, which will handle the Cincinnati work, will not increase its personnel.

Contract is awarded for Enders Dam, Neb.

Giving the green light to the Frenchman-Cambridge unit of the Missouri Basin project, the award of a $4,109,927 contract for construction of Enders Dam and Reservoir on Frenchman Creek near Enders, Neb., was announced Nov. 5 by Acting Commissioner of Reclamation William E. Warne. The contract has been awarded to the low bidder, the Wunderlich Contracting Corp. of Jefferson City, Mo. The dam will be a rolled earth structure about 2,570 ft. long and 100 ft. high.

Enders Dam and Reservoir of the Frenchman-Cambridge unit is the fourth of the 29 authorized initial stage units of the Missouri Basin project to go under construction. Kortes and Boysen Dams in Wyoming, and Angostura Dam and Reservoir in South Dakota, were under way before the construction limitation was effective.

Advance planning starts on Foster Creek Dam

An allotment of funds to initiate advance planning and preparation of the definite project report on the proposed $104,000,000 Foster Creek Dam in eastern Washington has been made to the Seattle District U. S. Army Engineers. The project is being prepared for construction as soon as the congressional appropriation is made, and the present allotment will enable the Seattle Engineer District to begin studies on planning the town site, access roads and highways and bridges.

The Foster Creek project is a power dam planned to span the Columbia River a quarter of a mile above the point where Foster Creek joins the Columbia. Latest power studies by the Bonneville Power Administration have shown that the power output of the first three units will be needed by 1952 to serve the Pacific Northwest.

The Army Engineers' Foster Creek survey report envisages a 7-year program for design of the project and construction of the first step in three units. Major construction will be started during the third year, with installation of the initial three generating units, each with a capacity of 64,000 kw. planned for completion at the end of the seventh year. The cost of the project is estimated at $71,000,000 for construction of the first three units and $33,000,000 additional for a total of 15 units.

A concrete gravity type dam, Foster Creek will be 220 ft. high with a reservoir backing water for 51 mi. to the foot of Grand Coulee Dam.

Engineering examiners see registration rise

National Council convention at St. Louis learns that 103,000 engineers are now listed in 47 states

The 50 member boards comprising the National Council of State Boards of Engineering Examiners have reported a total of 103,261 professional engineers and land surveyors as registered and in good standing, members of the council learned at their recent annual convention at St. Louis, Mo.

T. Keith Legare, executive secretary of the organization, told the more than 100 representatives attending the meeting, however, that the total of registrants contains some duplications, since some engineers are registered in several states.

He said that, with the addition of New Hampshire and Illinois during the past year, only Montana and the District of Columbia are now without representation on the council. Neither Montana nor the federal district has a registration law.

Reviewing the current status of engineering registration laws, Mr. Legare said in an annual report that 47 of the existing statutes are compulsory, and three—in Kansas, New Hampshire and Massachusetts—are optional.

Reviewing the number of registrants by states, the annual report showed that Ohio, with 15,617 engineers and land surveyors on the rolls, has the largest registration. Other states with large registrations, in order, include: New York, 15,268; Illinois, 8,718; Pennsylvania, 6,019; Texas, 5,949, and California, 5,104. The smallest registration was in New Hampshire, where 74 men were listed. More than 3,000 of the New York registrants are nonresidents.

Other actions

Members learned that the U. S. Directory of Registered Professional Engineers, which was published in 1943, had resulted in a financial loss to the publisher. The publication of another edition, therefore, will not be undertaken until support is assured.

The National Bureau of Engineering Registration, which began functioning in 1932 as a subdivision of the national council, reported that during the year 1945-46 it had received a total of 206 applications, of which 125 were approved.

New York City was selected as scene of the 1947 convention, to be held Oct. 27, 28 and 29 of that year.

New National Council officers seated at the meeting were: John C. Remington Jr., consulting engineer, Camden, N. J., president; George M. Shepard, chief engineer, Department of Public Works, St. Paul, Minn., vice-president; C. L. Eckel, of the University of Colorado, Boulder, western zone director; Alexander Blair, consulting engineer, Lake Placid, Fla., eastern zone director; and Mr. Legare, re-elected executive secretary.

Protest Idaho engineering contract

Award of a contract for engineering services in connection with the design and construction of a sewage disposal plant for Boise, Idaho, to the firm of Alvord, Burdick & Howson of Chicago, has been protested by Raymond J. Briggs, head of the Boise consulting engineering firm of Raymond J. Briggs and Associates, on the ground that no member of the Chicago firm is registered to practice in Idaho. Idaho's engineer registration law makes no provision for licensing engineers of recognized standing from outside the state without examination.

Recently the city called for sealed bids on the engineering work for the proposed sewage disposal facilities and received actual bids or informal proposals from about 40 engineering firms. After the bids had been opened, award of the contract was made to Alvord, Burdick & Howson on its bid of $39,000.

In his report to the city council, the mayor said, in part: "Consoer and Townsend submitted their bid at a total cost of $48,500, and C. E. Stockman at $40,500. Considering all provisions, I find that the bid of Alvord, Burdick and Howson is 16⅔ percent cheaper than the Stockman proposal. After a most comprehensive analysis, personally, I recommend in order of precedence the following: Alvord, Burdick and Howson, Chicago, Ill.; Consoer, Townsend and Associates, Chicago, Ill.; L. R. Stockman, Engineering Firm, with offices at Baker, Ore."

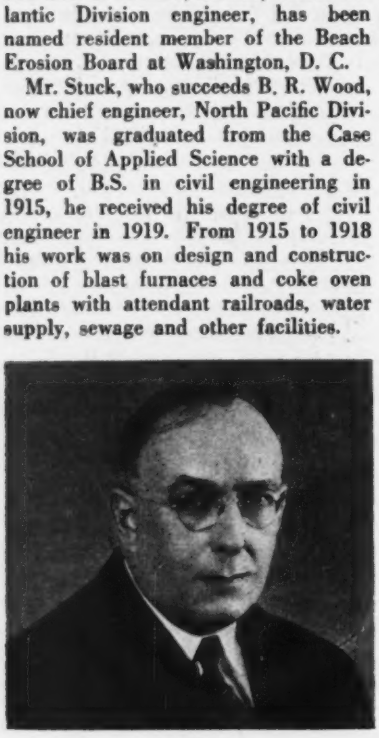
With respect to the criticism of the award of the contract to an out-of-state firm, the mayor said: "Without analyzing each bid carefully, there may be some criticism that a local firm was not recommended for this undertaking. However, most of the proposals locally were from general engineering firms whose character of work, experience and actual construction of projects, though of the highest type, showed a limited experience in the field of sanitary engineering. With all our complex problems of high water tables, irrigation, variable stream flow and contiguous territories that are unincorporated, the greatest certainty possible must be made to obtain services of such men or such engineering firms as have had broad and successful experience in the field of sanitary engineering."

Airport Expansion Planned—Condemnation proceedings are under way to provide space for a $10,000,000 expansion program for the Oakland, Calif., Municipal Airport. Master plan calls for three sets of parallel runways, each 10,000 ft. long, and enlarged harbor facilities on San Leandro Bay. To make the field more readily accessible to Alameda and San Francisco, an extension to the Navy-built highway at right is under construction.

R. W. Stuck, Col. C. L. Hall get new assignments

R. W. Stuck, formerly chief of the engineering division, South Atlantic Engineer division, Atlanta, Ga., has been transferred to Washington as chief engineer, Office of the Chief of Engineers; and Col. C. L. Hall, recently North Atlantic Division engineer, has been named resident member of the Beach Erosion Board at Washington, D. C.

Mr. Stuck, who succeeds B. R. Wood, now chief engineer, North Pacific Division, was graduated from the Case School of Applied Science with a degree of B.S. in civil engineering in 1915, he received his degree of civil engineer in 1919. From 1915 to 1918 his work was on design and construction of blast furnaces and coke oven plants with attendant railroads, water supply, sewage and other facilities.



R. W. Stuck

Subsequently, Mr. Stuck was resident engineer on design and of construction of an airship hangar at Akron, Ohio. Later he joined Arthur G. McKee and Co., Cleveland, Ohio, to go to Russia as manager and chief engineer for the construction of a $200,000,000 steel plant.

In May 1934, Mr. Stuck joined the Zanesville, Ohio, district, Corps of Engineers, on the Muskingum River Flood Control project. Assignments followed at the Passamaquoddy Tidal Power Development at Eastport, Me., and in May, 1936, to the division office at New York.

In 1941, Mr. Stuck was transferred to the South Atlantic Division in charge of the engineering and war construction work.

Heads erosion board

Colonel Hall relieves Lieut. Col. William B. Stelzenmuller, youngest resident member in the history of the board, (*ENR*, Sept. 12, vol. p. 339) who will remain for a time as assistant to Colonel Hall.

Colonel Hall was graduated from West Point in 1908, and took part in the punitive expedition into Mexico in 1916, in command of an engineer company. He went to France with the 12th Engineers in 1917, and served at the front before being assigned to the AEF General Staff.

For a number of years Colonel Hall has been a member of the Board of Engineers for Rivers and Harbors and during the last year he also has been the senior member of the Beach Erosion Board. He remains in the service under the provisions of the Rivers and Harbors Act of 1946.

Push building $18 million Toledo ship-rail terminal

Construction is well under way on an $18,000,000 dock being built to provide a new consolidated water-rail terminal for Toledo, Ohio.

On the south shore of Maumee Bay, 6 miles from the downtown section of the city, the facility will provide space for loading coal into ships, and unloading iron ore from the lake steamers. It it being built jointly by the Baltimore & Ohio and the New York Central Railroad.

Construction started last June and is scheduled for completion early in 1948. Included in the construction is the filling in of a stretch of land 2 miles long and a half mile wide to accommodate some 56 miles of railroad track that will be a storage and switching yard; the dredging of some 2,300,000 cu.yd. of mud to make a 25-ft. deep turning basin, and bulkheading operations to contain the fill. The terminal will be operated by the Lakefront Dock & Railroad Terminal Co., an equally owned company sponsored by the two railroads. The facility will replace one ore and three coal docks maintained separately by the railroad 5 and 7 miles up the Maumee River within Toledo proper.

New York ASCE Section to hear Sells and Noble

New York and New Jersey state highway development programs will be discussed at a meeting of the Metropolitan section of the American Society of Civil Engineers at the Engineering Societies Building, 33 West 39th Street, New York, on the evening of Nov. 20.

The speakers will be Charles H. Sells, superintendent of Public Works, New York state, and Charles S. Noble, state highway engineer of New Jersey.

Calendar of Meetings

NATIONAL

American Welding Society, annual meeting in conjunction with the National Metal Congress and Exposition, The Ambassador, Atlantic City, N. J., Nov. 17-22.

Construction Industry Advisory Council, Room "N", National Chamber of Commerce Bldg., Washington, D. C., Nov. 20-21.

Highway Research Board, 26th annual meeting, National Research Auditorium, Washington, D. C., Dec. 5-8.

National Society of Professional Engineers, annual meeting, Atlanta-Biltmore Hotel, Atlanta, Ga., Dec. 7.

American Association of State Highway Officials, annual meeting, Biltmore Hotel, Los Angeles, Calif., Dec. 17-20.

REGIONAL

American Water Works Association, Wisconsin Section, 25th anniversary meeting, Hotel Northland, Green Bay, Wis., Nov. 15-17.

American Water Works Association, North Carolina Section, Hotel Caroline, Raleigh, N. C., Nov. 18-20.

Big irrigation project started in Alberta

The first step in the construction of what will become the largest irrigation project in Canada, took place at the St. Mary's River, 41 miles southeast of Lethbridge, Alta., recently, when hundreds of visitors from the United States, Alberta and Saskatchewan gathered to watch hard rock miners start blasting for the first of two division tunnels in a hillside.

Work has already started on St. Mary's River Dam, the key to the project. It is hoped that water will be available for irrigation by August, 1949. The project is being financed by the Canadian government and is scheduled to cost $6,000,000.

Features of the development include:

1. River diversion tunnel and an irrigation outlet tunnel, both lined with reinforced concrete, 2,100 and 2,500 ft. long, and with a finished diameter of 20 and 17 ft. respectively.

2. The largest earth-fill dam in Canada, a structure which will form a reservoir flooding 9,200 acres and having an effective storage capacity of 292,000 acre-feet of water and only 28,000 acre-feet of dead storage.

3. Four miles of main canal, capable of carrying 3,200 cu. ft. of water per second from the reservoir.

Construction work is proceeding rapidly on the two tunnels, which will cost upwards of $1,000,000 when finished next summer. The river diversion tunnel must be finished by mid-April to carry the entire flow of the river while the dam is being built.

OBITUARY

Thomas M. McClure, 51, New Mexico state engineer, and recognized as one of the Southwest's leading authorities on underground water, died Nov. 5 at Farmington, N. M., where he had gone to represent New Mexico at a meeting of the Upper Colorado River Basin Compact Commission, of which he was a member. He also represented New Mexico on several other interstate stream regulatory commissions.

Chester J. Hogue, 70, a graduate of Massachusetts Institute of Technology and well known in the field of timber engineering, died Nov. 4 in Seattle, Wash. He was in charge of trade promotion, engineering and research for the West Coast Lumbermen's Association until his retirement last January.

Fred Hesse, 76, engineering head of the Portland, Ore., firm of Hesse-Ersted Co., died Oct. 29 in that city. He was a consulting engineer in the rebuilding of San Francisco in 1906 after the 1906 earthquake and fire.

Herbert I. Jacoby, 68, a construction engineer for The Ballinger Co., died in Philadelphia, Pa., Nov. 1.

Fred Johnson, 69, construction engineer, died at Laguna Beach, Calif., Oct. 23. He was graduated from the engineering school of the University of Kansas in 1901. For many years he was a resident of Kansas City, Mo.

William H. Murphy, 85, retired contractor, died in Chambersburg, Pa., Oct. 27. He was long engaged in construction in Harrisburg, doing much state road work.

John J. O'Connor, 59, died Nov. 1 at Red Bank, N. J. A graduate of the University of New Hampshire, he was for a number of years construction engineer for General Electric Co., at Lynn, Mass. He was employed for six years as a construction engineer for J. M. MacDonald Bros., Boston and New York.

Matthew A. Tracy, 72, retired engineer of Conshohocken, Pa., died Oct. 28 in Norristown. He was graduated from the University of Pennsylvania engineering school in 1895.

Paul M. Wells, 64, of the engineering staff of Maumee County and the City of Toledo, Ohio, planning commission died Nov. 2. A graduate civil engineer of Ohio State University, and a specialist in road construction, Mr. Wells had supervised street and highway work in many parts of Ohio. For several years he served as junior partner and general superintendent for Knight and Wells, Columbus, Ohio, paving contractors. Before the war he was assistant engineer for the Civil Works Administration and also project engineer and area engineer for the Works Progress Administration in Ohio.

Charles Green Waitt, 78, formerly civil engineer for Travelers Insurance Co., died at Brighton, Mass., Nov. 3. He was graduated from Massachusetts Institute of Technology 1892, and designed and constructed many buildings in the greater Boston area.

John S. W. Holton, 83, president and a founder of the Joint Executive Committee on the Improvement of the Harbor of Philadelphia and the Delaware and Schuykill Rivers, died October 31 at Merion, Pa. His leadership resulted in bringing about the dredging of the original 26 foot channel in the Delaware, completed in 1889, and later enlarged to its present 40 feet.

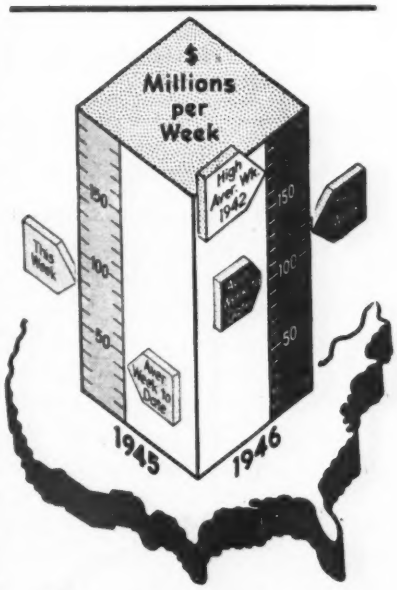
Charles M. Brogan, 52, civil engineer, recently Federal Housing expediter for Lancaster County, Pa., and project engineer for the United States government for the preceding 12 years, died recently in Philadelphia. He was graduated from the University of Pennsylvania in 1916. He was formerly associated with his father, James F. Brogan, in a contracting business. The firm worked on the subconstruction of the Philadelphia Museum of Art and on bridge construction for the Pennsylvania Railroad.

Henry J. Bangert, 66, president of Bangert Brothers' Construction Co., died Nov. 5, St. Louis, Mo. He was formerly secretary of the board of supervisors for the St. Ferdinand Sewer District. His construction firm, which he formed with his brother, Louis Bangert, specialized in road building in the middle west.

Simon James McLean, 75, for 20 years chief Commissioner of the Board of Railway Commissioners of Canada, and recently technical adviser to the board, died at Ottawa, Ont., Nov. 5. Mr. McLean was graduated at Toronto University in 1894 and took postgraduate courses at Columbia and at the University of Chicago.

For engineering school news and other additional items see page 168.

CONSTRUCTION ACTIVITY



As Reported this week to ...
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Nov. 14 1946	Cumulative 1946 (46 wks.)	Cumulative 1945 (46 wks.)
Federal	$30,495	$592,325	$716,653
State & Mun.	37,149	1,288,080	335,073
Total Public	$67,644	$1,880,405	$1,051,726
Total Private	44,847	2,856,662	893,908
U. S. Total	**$112,491**	**$4,737,067**	**$1,945,634**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1946 (46 wk.)	Cumulative 1945 (46 wk.)
Waterworks	$1,281	$98,649	$51,357
Sewerage	2,118	101,249	29,998
Bridges	3,248	119,052	39,377
Highways	21,949	709,494	203,184
Earthwork, Waterways	10,122	330,230	50,433
Buildings, Public	26,934	374,924	439,226
Industrial	6,924	949,424	503,646
Commercial	34,314	1,725,162	281,856
Unclassified	5,601	328,883	346,557

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

		Cumulative (46 wk.) 1946	Cumulative (46 wk.) 1945
NON-FEDERAL			$687,851
Corporate Securities	Current		179,430
State and Municipal	figures		344,821
RFC Loans	not		24,600
REA Loans	available		60,000
Fed. Aid Highway			79,000
FEDERAL			1,049,898
Total Capital			$1,737,749

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	Nov. '46	362.47	174.24
Building Cost	Nov. '46	273.71	147.96
Volume	Oct. '46	233	102

EDITORIALS

VOLUME 137 NUMBER 20

November 14, 1946

Better Price Control

THERE is a misleading connotation in the common statement that "price controls are off". Actually, only governmental controls have been removed. They are replaced by the control exercised by supply and demand, by the bargaining of seller and buyer. And as stated in these pages more than a month ago, that is the best type of price control for construction, and the only one that can be effective. It was a noble experiment, and useful up to a point, to impose ceilings on prices until the complete scarcity of certain building materials could be eliminated. The usefulness of the device passed away, however, when production was sufficient to make black market operations attractive and when the manipulation of price ceilings to encourage production became so complicated as to be unworkable. With governmental price controls off, production of building materials will follow demand, rather than being limited chiefly to those items whose price ceilings permitted the greatest profit. Critical shortages should thus be reduced and the whole material supply picture improved. With materials available, the best type of price control—buyer control—will become operative. Its first result will be uniformity of prices, and then, as stability returns to the market, lower construction costs. A corner has been turned.

Foresighted Construction Planning

A LONG STEP FORWARD in wise planning for a huge construction project was taken at Bismarck, N. D., late in October when 35 contractors and construction equipment manufacturers met with the staff of the U. S. Engineer Office to exchange opinions on how best to tackle the job of building Garrison Dam on the Missouri River, the largest rolled-fill dam in the world (see p. 89). The meeting was called by Col. W. W. Wanamaker, district engineer, whose task it will be to build the best structure possible at the lowest cost. Such preliminary coordination of the three basic units of a big job—engineers, contractors and equipment builders—offers such obvious advantages that it is surprising that it is not called for more often. The engineers learn how skilled contractors would plan their operations for the most efficient construction; both they and the contractors, in turn, have an opportunity to consult with the equipment men as to the best types of machines or as to the possibility of using specially designed equipment for a job of such magnitude; and, finally, the contractors, who next year will be asked to bid on the job, gain an intimate knowledge of what is proposed in ample time to develop their own thinking as to the best method of attack once the general requirements have been specified. As a result, this meeting of minds could mean a saving of several millions of dollars on a project now roughly estimated to cost $200,000,000. It could well be that the Garrison Dam sessions, following the recent Philadelphia conference on deep dredging to eliminate locks in the Panama Canal, represent a milestone on the road to better planning for large public-works projects.

Grouping Road Contracts

STATE HIGHWAY DEPARTMENTS are finding it profitable to group contracts for resurfacing. Under this plan, a contractor can bid on enough work to keep his force engaged continuously throughout the construction season, thus minimizing moving costs and lost time as well as facilitating the retention of experienced workers. As a result, the highway department gets more favorable bids than it would for isolated jobs of short duration and the contractor is given a better opportunity to profit from his skill in organizing construction operations. Kentucky now is extending this system to the secondary road work done under state auspices, as reported on p. 117 of this issue. A further variation of the plan might be the segregation of grading contracts from paving contracts and the further break-down of grading operations into heavy and light work, thus fostering the development of contracting firms specializing in each type of work who could look forward to a progression of similar operations during each season. Such a plan might also be the answer to the problem of getting bidders on light grading, which was found to be serious in Missouri (p. 109).

More and Better Sewage Treatment

NOT A LITTLE PRIDE can be taken in the fact that despite this nation's preoccupation with the war, steady progress also was made in providing facilities for safeguarding public health. The role of the sanitary engineer in this regard is evidenced

in an inventory of sewage disposal facilities made by *Engineering News-Record* and published elsewhere in this issue. Here it is revealed, among other things, that in the seven abnormal years since the last report, more than 1,000 sewage treatment plants and some 1,200 sewer systems were added to the nation's sanitation facilities. We also learn that there are now 5,685 communities in the United States with sewage treatment plants serving almost 48 million people. While such accomplishment is commendatory, it should not obscure the fact that much more remains to be done. One index of the job ahead comes from the knowledge that to bring up our standards of sanitation facilities in accordance with needs calls for sewage treatment facilities in 7,411 communities to serve an additional 28 million people. This points to the obvious conclusion that the bulk of future construction will be centered on small-capacity treatment plants. And it follows that since such small installations cannot command the highly skilled operation afforded to large works, effective performance must rely on simplicity and ruggedness of design. Herein lies a challenge to sanitary engineers and manufacturers of sanitation equipment as they look forward to the task ahead.

A Great Project Pays Off

CITIZENS of the Miami River valley in western Ohio were given particular reason recently to enjoy a feeling of pride and self-satisfaction, as well as to deserve the plaudits of the rest of the country. By finishing the liquidation of a debt of nearly $50 million, self-contracted to pay for local flood protection, they had brought to successful conclusion a project that has continuously gained in stature and significance over its three decades of existence. Its success may be measured by a brief review of its history.

During the period March 22-27, 1913, the Miami valley and its industrial cities of Dayton, Hamilton and Middletown, suffered crippling destruction from the worst flood in history. Leading citizens of Dayton, having seen their city periodically damaged by flash floods, decided to do something about protection and engaged the Morgan Engineering Co. to study the possibilities. At the same time they spearheaded a drive in the Ohio legislature to obtain authorization for the formation of flood-control districts, which could finance and operate the necessary facilities.

The outcome of this pioneer effort was twofold in setting remarkable precedents. The Ohio Conservancy District Act, passed Feb. 17, 1914, set the pattern upon which all subsequent similar state acts have been based. And the study made by the Morgan Engineering Co. developed the over-riding importance of detention reservoirs in flood-control technology. Moreover, it showed conclusively the advantage of treating a river system as a unit in flood-control planning, as against the prior practice of trying to protect a local area by levees or bypass channels.

From this auspicious beginning and under the wise direction of Arthur E. Morgan and the aid of many engineers, later to become even more famous than they then were, the district continued to set precedents. Combining hydrological and model studies, the preliminary work exceeded in scope and cost anything before attempted. Earth dam design was refined beyond then current practice, conduits were designed for exceptional velocities and capacities, and coordination of reservoir detention and controlled channel flow was introduced.

As was noted in the beginning, the Miami Conservancy District was financed solely by its benefited residents. It may be longest remembered for this fact, since local responsibility rather completely disappeared as a tenet of flood-control policy in the 1930's. In contrast to the $50 million spent by local residents in the Miami valley, those in the nearby Muskingum valley contributed about $7 million in land costs to their $43 million comprehensive program begun in 1933. The change was perhaps inevitable when the scope of flood control broadened to such enterprises as those in the Tennessee, the Connecticut and the Missouri River valleys. Yet one cannot escape the conclusion that definite and sizable local participation in the costs of flood control is essential if wasteful expenditures on protection facilities of doubtful value are to be avoided.

If future projects cannot copy the Miami Conservancy District entirely, they can at least be set up to emulate its rugged individualism a little more closely. Were that to come about the nation's debt to this great project, already large on the technical side, would be significantly increased.

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WALDO G. BOWMAN, *Editor*, EDWARD J. CLEARY, *Executive Editor*.
New York: V. T. BOUGHTON, R. K. TOMLIN, H. W. HUNT, E. E. HALMOS, JR., T. D. MacGREGOR, H. P. ORLAND and F. S. MERRITT
Chicago: V. B. SMITH, J. R. CARR, *Washington:* A. N. CARTER, *San Francisco:* N. A. BOWERS, L. L. WISE
EDITORIAL OFFICES: 330 WEST FORTY-SECOND STREET, NEW YORK, N. Y.

Draining Coarse Gravel with Wellpoints

Contents in Brief—Dewatering of the excavation for a 75,000 kva. power plant on the Allegheny River was accomplished with wellpoints, despite coarse gravel and broken rock subsoil, under a subcontract to keep the work area dry. Except for a central water tunnel the entire foundation is at the same elevation, simplifying water handling, excavation and machinery support.

DESPITE a high watertable fed from the nearby Allegheny River through coarse gravel and broken sandstone rock, a subcontractor for dewatering was able to keep dry a 250 x 200-ft. excavation for a 75,000-kva. power plant for the Pennsylvania Electric Co. at Warren, Pa. General excavation had to be carried to a depth of about 32 ft. with a cooling-water trench an additional 9.5 ft. deep across most of the 200 ft. length and continuing 150 ft. out to a screen house near the river's edge.

With the exception of the cooling water trench, the entire excavation and foundation for the powerhouse are at one level. Original ground was about El. 1190 with groundwater at El. 1170, or about the normal elevation of the water in the river, with which it fluctuates, thus indicating the previous natural condition.

With such subsurface conditions, the general contractor found it desirable to sublet the dewatering of the area to a firm specializing in such work, the contract being on a dry working-area basis for the entire construction period.

Despite broken rock and otherwise undesirable material, wellpoints were selected as the practicable means for unwatering. Excavation, with a 1:1 outside slope, opened the general area down to the groundwater level. The wellpoint system was planned and installed in advance of excavation below water level to keep the water out of the work area entirely instead of removing it later.

A single ring of 22-ft. long wellpoints at 10 ft. centers was installed

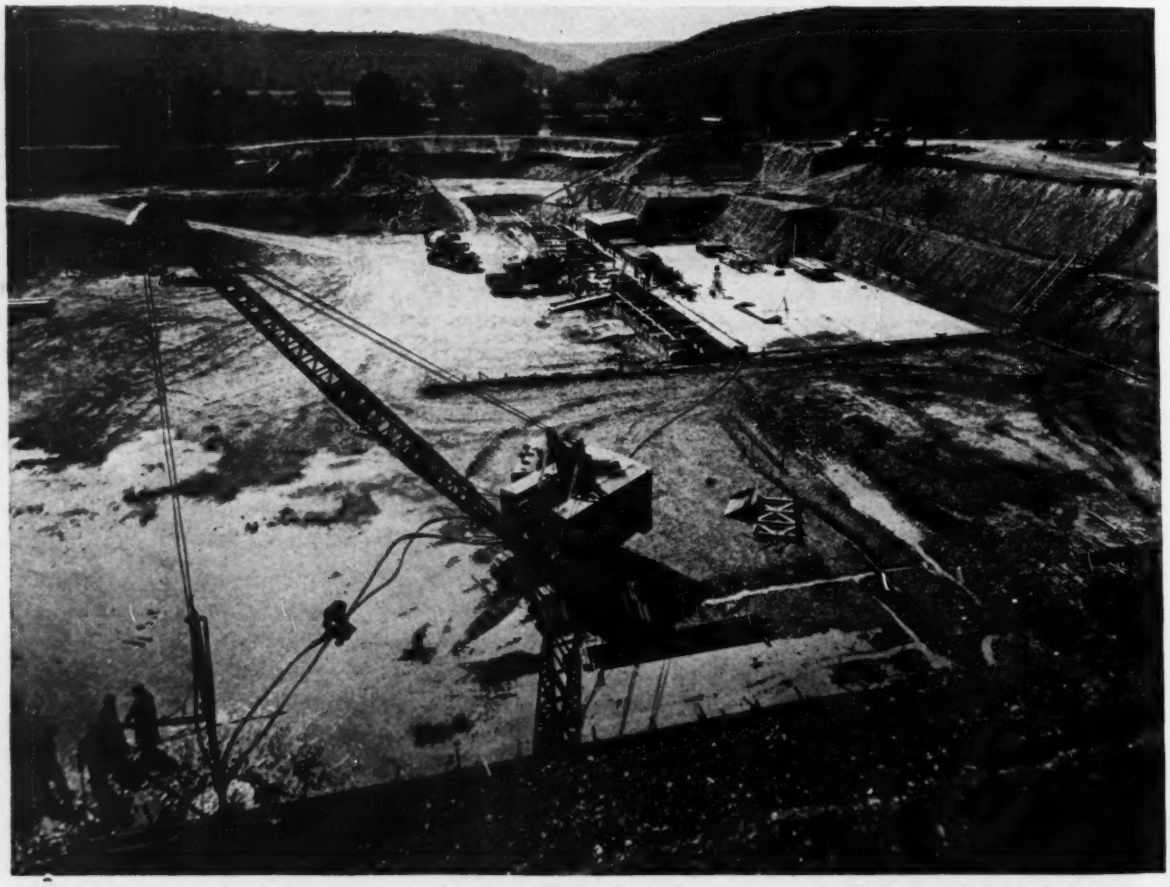


Fig. 1. Wellpoints being put down by a "hole-puncher" in the area to be occupied by the second unit of the plant. Flooding in the foreground is from the pressure jetting, not from the river.

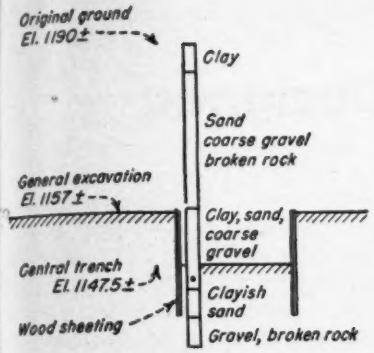


Fig. 2. A typical foundation boring is here superimposed on a section through the cooling-water trench to show the character of the material drained.

with the header just at the groundwater line and another at the level of the general site excavation. Points were put down through the coarse gravel and large sandstone rock particles by use of a "hole-puncher." This is a heavy casing with hardened cutting teeth at the bottom and a removable headpiece that is equipped to force a water jet down to the cutting edge and also is hooked up with an air line so that a combination of air and water can be used to loosen material around the outside of the puncher casing.

A crane handles the hole-puncher, which has a weight of 2,500 lb. and is equipped to be rotated during the jetting. Rotation is accomplished manually by a "bull stick" that is rigged to turn the pipe, gripping it by means of bars welded along the length of the pipe. The rotating device is hung from the headpiece with a block and fall arrangement that is used to hoist it up the casing as the hold deepens. On this project, an average of 20 min. was required to jet the casings to a depth of 22 ft. The head of the puncher was then removed, a 2-in. dia. wellpoint dropped inside and the casing withdrawn.

Once the main ring of wellpoints was functioning, the excavation was done by power shovels and trucks, operating anywhere over the general foundation level, 13 ft. below groundwater. The second ring protected the deeper cooling-water trench and assured a completely dry work area.

To avoid disturbing the natural ground along the 22-ft. wide and 9.5-ft. deep cooling water trench near the center of the foundation, wood sheathing was driven and braced prior to excavation. Concrete in the trench was placed against the sheathing, which is left in place but cut off at the elevation of the main foundation.

The concrete base slab is 4 ft. thick and heavily reinforced, covering the entire area of the power house. It provides the spread footing for the structure as well as the mass weight required for machinery foundations. By use of the single large footing throughout to the same elevation, the designers attained substantial economies in unwatering, excavation and form building compared to digging out small areas and building small footings.

As a part of the permanent plant, four bronze wellpoints were installed below the permanent groundwater level to supply 200 gpm. for boiler feed-water and general use. Cooling water is taken directly from the Allegheny River.

The power plant was designed by Gilbert Associates, Inc., of Reading, Pa. General contract for construction is held by Berkebile Bros. of Johnstown, Pa., and dewatering was done by the American Dewatering Corp. of New York.

Fig. 3. Closeup of water jet "hole-puncher", which is rotated by hand. Air is connected to assist penetration with an air and water slug.

Fig. 4. A supplemental line of wellpoints was used to insure dry working conditions in the trench for the cooling-water intake.

Welded Frame Building Designed For Heavy Loads

Mark Falk
Structural Engineer
Franklin, Kump & Falk, Architects and Engineers
San Francisco, Calif.

***Contents in Brief**—Fully continuous welded steel construction was used to good advantage in the design of a three-story Fresno, Calif., building with heavy loading. Compared with ordinary steel design, a saving in amount of steel was effected by careful attention to design of details for most advantageous use of welding.*

USE of fully continuous welded construction minimized the steel required for a three-story raisin-packing plant constructed recently in Fresno, Calif. Long span and heavy load requirements made steel construction advisable. Field welding was kept to a minimum and was restricted as much as possible to down-hand welding.

To accommodate trucks for loading and unloading raw and finished materials in the ground floor of the building, 36-ft. spans were specified. Accordingly, columns for the 145x145-ft. building were spaced 36 ft. apart in one direction and 24 ft. in the other. As the upper floors were required to support a live load of 400 psf., the 36-ft. span required heavy steel girders. Steel floorbeams spaced 6 ft. apart were used for the 24-ft. span.

A study of welded steel design indicated that, by use of suitable details, the girders could be made continuous over the columns. Bending moments acting in such continuous or fully restrained framing are less than for framing in which flexible or partially restrained connections are used (see *ENR* Oct. 10, 1940, vol. p.484 for a method of analysis). For example, this design permitted the use of 33-in., 200-lb. girders instead of 36-in., 300-lb. girders.

Erection simplified

Design of details permitted fabrication tolerances comparable to standard riveted construction. Thus, the steel frame was erected, plumbed and welded in approximately the same number of man-hours as would be required by a conventional riveted job of similar size.

In this particular job, the size and scope of the work are not of as much interest as are design details for welded connections. Three such joints will be discussed in more detail, namely: (1) Girder, column, and floorbeam joint; (2) girder splice; and (3) field beam connections.

The most significant detail on the job is the girder, column, and floorbeam joint (Figs. 2 and 4). Attempts

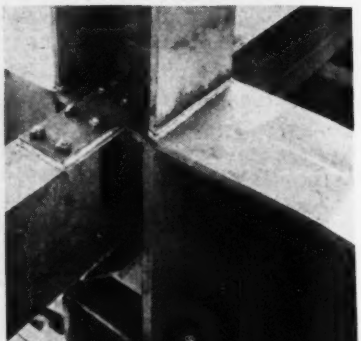


Fig. 2. Girders were made continuous at the columns to take advantage of decreased moment in a fully continuous frame.

Fig. 1. The design of this welded steel building was such that easy down-hand welding was used for most of the field welds. Some 450 tons of steel were used.

to achieve girder continuity in welded design with columns extending through the joint as in normal riveted design have invariably resulted in heavy, complicated systems of web connections and flange yoke plates. Therefore, the girders were made continuous through the joint and the columns were cut off above and below the girders. To do this it was necessary to provide some means of carrying the heavy loading from upper floor columns through the girders and also provide rigid connections between the girders and columns capable of resisting the bending moments due to horizontal forces such as wind and earthquake.

This was done by welding four plates, each approximately one-half of the lower column flange in section, between the flanges of the girder where it passes over the column. These plates act as column flanges in the girder section and were welded to the girder in the shop. The load carried by the column web is transferred through the girder web to the column below. Field welding at this joint consisted of welding the top of the column to the bottom of the girder and the bottom of the next column to the top of the girder (Fig. 3).

The column and girder joint was complicated further by the necessity for a floorbeam connection at that joint. Floorbeam connections to girders not at a column are relatively simple and will be described later. As it was desired to have the top of the girder and the top of floorbeams at the same elevation, the beam support had to be part way up on the girder. The support consists of an angle and a plate welder to the girder and to the plates which stimulate column flanges in the girder section. The angle is primarily to carry the vertical load and the plate to transmit bottom-flange compression. The floorbeams were temporarily bolted to the plates and then welded with a down-hand weld.

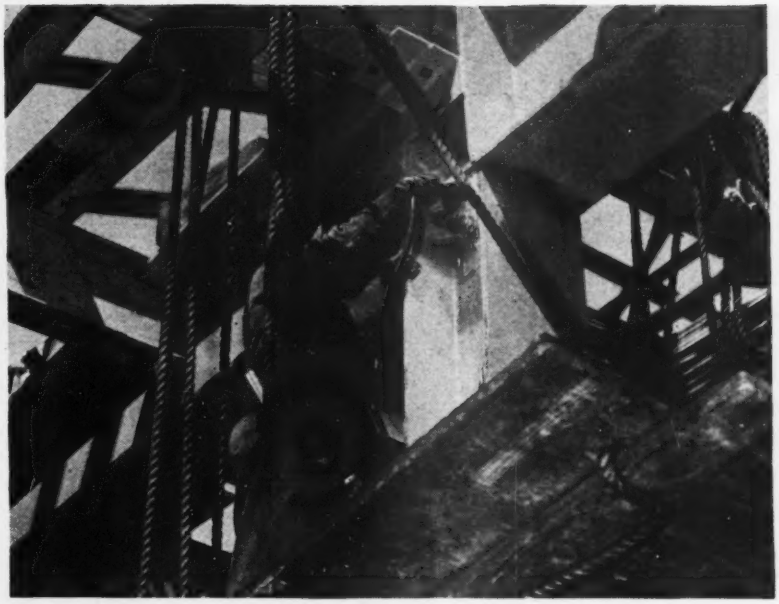


Fig. 3. The only overhead welding on the job was at girder and column joints. Much welding was done in the shop.

It was also necessary to provide some connection at the top flange of the floorbeams to transmit top-flange tension. This was accomplished by welding the short leg of an I-beam section, cut so that it simulated an angle with one short leg and one long leg, to the bottom of the column. The long leg was first used as a temporary field connection for the column and girder. When the floorbeam was inserted it was also temporarily bolted in place. The long leg was later welded to both the girder and the floorbeam (Fig. 2).

Fieldbeam connections

Typical fieldbeam connections to girders can be seen in Figs. 1 and 5. To provide vertical support, brackets made of a piece of an 8-in. I-beam were shop welded to the girder webs. Floorbeams were rested on these and temporarily bolted until field welding could be done.

Continuity of floorbeams at the girders was achieved by welding the bottom flange to the brackets and providing a splice plate connecting two floorbeams across the top flange of the girder (Fig. 5). This plate was welded to each floorbeam but not to the girder.

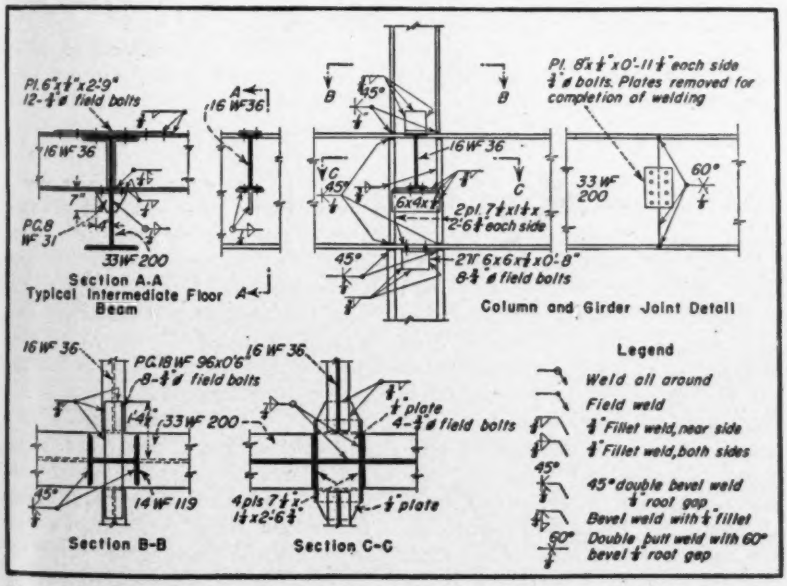


Fig. 4. Joint details were designed to take full advantage of welding. Some important joints are here shown.

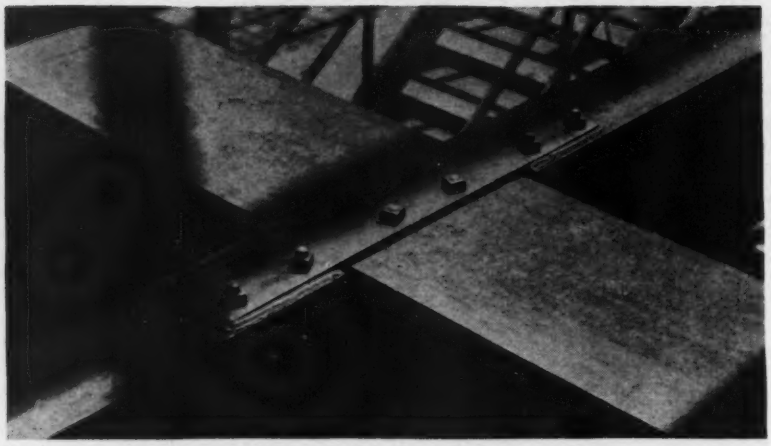


Fig. 5. Floor beams were joined to the girders by a plate spanning the girder. Bolts are for construction purposes only.

The girder splices were also of interest. To span the four 36-ft. bays, I-beams (44 ft. 9 in., 54 ft., and 44 ft. 9 in. long respectively) were used with splices made at points of minimum moment. A temporary field connection was first made by bolting the two girders together with fish plates. Flanges and exposed portions of the web were then welded with two passes and the plates removed, after which the full butt-weld was completed.

Design of the building was modified somewhat to facilitate construction. It was originally intended to provide a reinforced concrete shell and a structural steel interior frame. This required lightweight exterior steel columns for construction purposes only, later to be incased in concrete. As the reinforced concrete shell and the steel frame were to be erected by two different contractors, their work would overlap and a possible conflict could have resulted. Besides this, concrete work might have been delayed by steel deliveries. To overcome these objections, structural steel columns were omitted from the first floor walls. The lightweight exterior steel columns in the walls above the second floor were rested on the previously constructed first story form-work. Thus the general contractor was able to start work by pouring footings and erecting formwork while the steel was being fabricated. The steel contractor then moved in and erected the entire steel frame.

The building was constructed by Fisher & McNulty, Fresno, for the California Packing Corp., H. A. Calkins, chief engineer. Structural design was originated by the author and details prepared by S. F. Bamberger. Structural steel was fabricated and erected by the Bethlehem Pacific Coast Steel Corp.

Kentucky City Gets Court Sanction for Condemning Property for Parking

The Court of Appeals of Kentucky has rendered a decision of significance concerning the question of the provision of parking facilities as a municipal or public function. In deciding that the provision of public parking lots for automobiles constitutes a legitimate municipal purpose the court took cognizance of the present needs of the motoring public as well as of the greater public welfare of the citizenry in general.

The most important features of this case, the decision of which is a precedent that will be scrutinized by local and state authorities, are as follows: The board of council of the city of Georgetown, Ky., adopted an ordinance setting forth the need for public off-street parking facilities and for that purpose authorizing the acquisition, through condemnation if necessary, of two tracts of land near the business district, one owned by a corporation and one by an individual. Both owners resisted, and the city instituted condemnation proceedings in the Scott County court, which sustained the defendants' demurrer and awarded judgment for them.

City's intentions sustained

Upon appeal by the city, the circuit court reversed the ruling of the lower court and the Court of Appeals affirmed the decision of the Circuit court, sustaining the city's intentions.

Part of the wording of the decision is of special interest. It reads: "Subsection 8 of Kentucky Revised Statutes 86 110 authorizes in general terms the city to purchase or condemn real estate which it has declared by ordinance is needed for municipal purposes. Although the power of eminent domain is not inherent in municipalities and may not be exercised by them without statutory authority, it is not necessary that the statute should specifically mention streets, alleys, highways, or other purposes for which the municipality may condemn property. The general power of condemnation for appropriate municipal purposes confers the authority to condemn for every necessary municipal purpose in the opinion of the court.

"Is then the acquisition and use of land by the city for a parking lot a municipal purpose? It is a matter of common knowledge that the great increase in recent years of motor vehicles has created a situation, even in the smaller cities, which is fraught with danger to persons using the streets and causes inconvenience to the residents of the city. Under the power to regulate the use of vehicles on their streets, cities may, and frequently do, prohibit parking on the streets in congested areas, and the right to furnish parking space is a necessary adjunct to the right to regulate traffic, otherwise it would be impossible to achieve the general objectives of the statutory grant of power to regulate the use of streets by vehicles. One of the main objectives is the protection and safety of the citizens."

Principles of Noise Reduction In Offices and Factories

M. A. Smith
Acoustical Engineer
United States Gypsum Co.

***Contents in Brief**—The first principle of noise reduction is to avoid making noise. This can be achieved by proper selection, design and mounting of machinery and use of sound-insulating constructions and devices. When noise cannot be avoided, its effect can be reduced by lining the boundaries of the room with absorptive materials, which are available in a wide range of acoustical properties. Calculations aid in selecting the proper material.*

To ACHIEVE quiet working areas in offices, factories and many other types of building occupancies, designers are faced with the problem of either eliminating the sources of noise or reducing its effect on personnel. Either procedure may affect the design of the building, the former chiefly influencing machine mountings and the floor system and the latter affecting working-area layout, interior finishes, walls, floors, ceilings, partitions, sash and doors.

Almost 80 percent of the footage of acoustical materials currently used in buildings is applied to correct faults discovered after the building is in use. Yet, many of these could have been predicted from the plans and their correction effected during construction at a considerable saving to the owner. It seems logical—and certainly it is economical—for architects and engineers to give consideration to acoustical problems during the design stage to gain the additional usefulness that quietness produces for owner, tenant and employees.

The reduction of noise levels in offices increases the over-all efficiency of employees upwards of 10 percent. In stores, for example, high noise levels make it necessary for clerks to ask customers to repeat their instructions, both over the counter and over the telephone, and more clerks are needed to handle an equal volume of trade. In factories, it is not yet possible to assess the advantages of quiet with full assurance, but there is every indication that the benefits are even greater and there is assurance of a reduction in lost-time accidents.

Elimination of noise sources

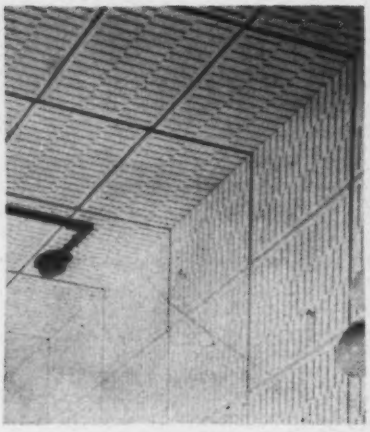
Through the use of sound-absorbing material and sound-insulating constructions, architectural acoustics provides solutions for the problems of "wanted" sound (as in auditoriums) and of "unwanted" sound (noise). Both problems arise because room boundaries are not sufficiently sound-insulative to exclude unwanted noise and because sounds that originate in a building cannot pass out through the walls to oblivion, but are bounced back and forth within the room of their origin until they are reduced to inaudibility. Since engineers are more frequently called on to handle noise problems than to correct the difficulties of audition in auditoriums, this discussion will be confined to an elemental treatment of the problem of industrial noise.

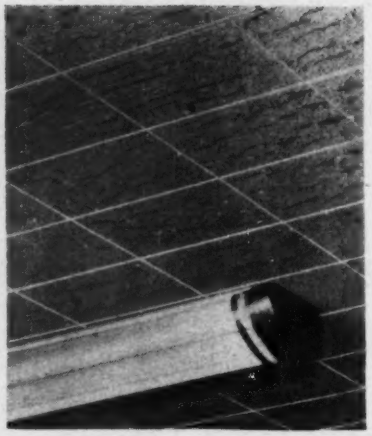
The first principle of noise reduction is: Don't make it. Machine designers should consider the noises their creation produce. Machines with rotating parts in which the center of mass does not coincide with the axis of rotation will produce noise at speeds above 1,200 r.p.m., increasing in loudness with the eccentricity. Unbalanced oscillating parts likewise offend. Many machines use impact to form materials where gentler pressing, as in a tinsmith's brake, might be equally effective mechanically and almost noiseless.

Small parts are generally forcibly ejected into metal containers by many devices. Padding of the bins with felt and canvas, or with rubber, and the use of rubber-lined chutes, curved so that friction reduces impacts, may help to reduce industrial din.

Machinery offends in two ways: (1) The noise it produces is heard within the room and is enhanced in loudness by the room effect, which will be explained later. (2) If the vibrations of the machine are sufficiently vigorous and rapid, vibrations may convert the floor into a veritable loud-speaker. Even though the frequency of vibration of the machine may be too slow to be audible, if it is transmitted to a floor, loose objects on the floor may be disturbed or set into vibration, thus creating noise. Vibrations produced in floors are commonly transmitted to the entire structure and may sometimes be heard several floors away.

One method of eliminating this source of noise is to use a commercially available, properly designed resilient base, which should be "hand tailored" to suit the weight of the machine, the position of its center of gravity (to prevent undue oscilla-





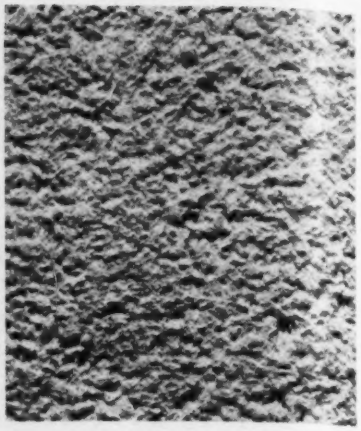


Fig. 1. Acoustical materials of various types differ in texture. At the left is an installation of wood-fibre acoustical tile in a motor test room in an office building. In the middle is a mineral-fiber tile installation in a steel testing laboratory of an industrial plant, while at the right is a full-size close-up of an acoustical plaster.

tion in the machine itself) and the frequency of the imposed vibration.

The major room effect previously mentioned is reverberation. With the average ability of normally constructed room boundaries to absorb but 0.03 of the sound energy at each reflection, whereas sounds travel around in a room at about 750 mph., sound remains audible for several seconds. The time that sound of specified loudness and pitch remains audible after the source ceases is known as the reverberation time of the room. It can be calculated from

$$t = \frac{0.05\ V}{a}$$

where t is the time in seconds for a room of V cu.ft. in volume and a the total sound absorbing power of the room. The absorption a is calculated by multiplying the total area of each variety of material exposed to the sound by its absorption coefficient per sq.ft. and adding the products.

In a reverberant room, sounds persist and interfere with the audibility of sounds subsequently created. Thus, if one has to purchase machinery that is inherently noisy, the enhancement in the noise level produced by the room effect is important. This can be illustrated with a specific example.

Room effect calculated

In an average office area, say 80 ft. long and 40 ft. wide, with a 10-ft. ceiling, the volume is 32,000 cu.ft. and the total area is 8,800 sq.ft. If we assume that the boundaries are made of plaster in the walls and ceiling, glass in the windows, possibly linoleum on the floor and wood in the doors, we can safely average their acoustical absorption as 0.03 units per sq.ft.

The total absorption, for sound in the empty room, will be 264 units (8,800 × 0.03), and the reverberation time

$$t = \frac{0.05 \times 32{,}000}{264} = 6.07 \text{ sec.}$$

This means that sound of test loudness created will be audible for six seconds after the source has ceased.

The average stenographer produces between 5 and 6 clicks per second on the typewriter when writing between 90 to 100 words per minute. If we asume 5 clicks per second and that each click has an initial loudness of 60 decibels, at any given instant in this particular room there will be audible the sum of the remnants of 30 clicks of the typewriter, each in varying condition of loudness and the last one audible at full intensity.

If we apply 3,200 sq. ft. of an absorptive material having a noise reduction coefficient of 0.70 to the ceiling, we will increase the total absorption in the room to 2,408 units. Using the new absorption, we calculate that the reverberation time after treatment will be 0.66 sec., and we find that at any instant less than 4 clicks of the typewriter will be audible. Actually, since the click of a typewriter falls somewhat short of 60 decibels in loudness, the above is not fully factual. However, many industrial noises are much louder than 60 db., for which the comparison would be inadequate.

The acoustician interprets this reduction in loudness more understandably when he expresses it in decibels as a reduction in the noise level due to the acoustical treatment, as given by 10 times the logarithm to the base 10 of the ratio of absorption after treatment to absorption before treatment. Calculation of this when made for the room in question shows that the treatment lowers the noise level by 9.6 db.

For comparison purposes, a difference of 10 db. in loudness represents the difference between a very quiet office and an average office, or between an average office and a very noisy office. Also, 10 db. represents about the maximum difference between original loudness and reduced loudness that one can obtain by the use of acoustical treatment in the average room. Where the rooms are small, the reduction is less, and likewise where the rooms already provide a considerable amount of absorption by the clothing of employees and by desks, and other furniture, the reduction is still less.

Sound insulating requirements

It is impossible to set points at which monetary benefit is gained through quiet. In an office, a reduction of but 3 db. which is easily obtained in practically any room, is quickly observed with satisfaction by employees and management and is sufficient to produce a measurable increase in efficiency among the employees in the room.

When it is necessary to confine sound to the room of its origin, re-

liable information for the design of room boundaries may be obtained from Bureau of Standards publication *BMS-17*, which contains details of construction and information on the transmission loss of a wide variety of partition and floor structures.

To calculate sound-insulation requirements, one must know the loudness expected within the room. This can be obtained by measuring loudness levels in existing rooms used for like purposes. If acoustical material is to be used on the ceiling or other surfaces, the loudness level, considered as a load on the boundaries, can be decreased by the reduction in the noise level effected by the acoustical treatment. The noise level that normally exists in the protected rooms that surround this room must also be known. The difference between the two levels represents the minimum transmission loss the boundaries of the room must provide.

As an example, suppose we wish to build a normally quiet office, in which a noise level of about 42 db. exists, adjacent to a machine room where the loudness level is quite high, say 82 db. If the design is to be successful, the partition structure and all of its parts built around the noisy room, as well as the floor and the ceiling of that room, must not have a lower noise reduction than 40 db. If, through acoustical treatment, we effect a reduction in loudness level in the machine room of 5 db., then its boundaries need show a transmission loss of but 35 db. to be acceptable, since the sounds that would then come through the boundaries to the office would be masked by the existing sound level there.

Fig. 3. Acoustical cement is applied in dabs before application of tile to a plaster surface.

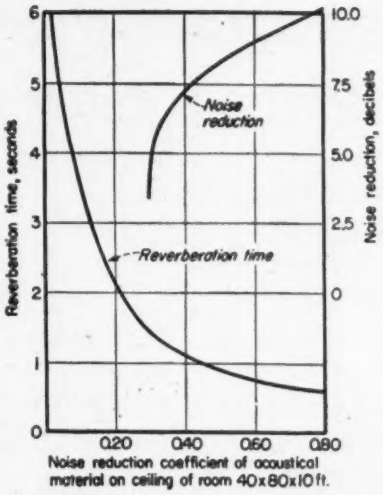


Fig. 2. As the noise reduction coefficient of acoustical material installed in a given room increases, the reverberation time decreases and the noise reduction increases, but at a continuously decreasing rate.

It must always be borne in mind that insulating the partition between a noisy and quiet room will not prevent sound from being carried over, under or around the insulating wall. Doors, windows, ducts and conduits that, of necessity, pierce the construction are weak spots. The only safe procedure is to confine the noise by sound insulating all of the boundaries of either the noisy or quiet room.

Acoustical constructions

In the sound-insulative classification, we have special partitions that can be constructed by anyone and which are described in *BMS-17*, as well as other constructions that are installed by acoustical contractors and which may have some advantages over the former.

There are also available soundproof doors that are useful. Ordinary doors are rarely as efficient as the partition structure.

To build efficient means of access and exit to the noisy room, one can resort to the construction of a vestibule whose interior is lined with a fairly efficient absorbent and whose doors must be forcibly pulled against rubber stops in order to be latched. The doors should be solid, at least 2 in., and preferably 3 in., thick.

Acoustical materials are available in a wide range of absorption at a considerable variation in price. The purchaser must not jump to the conclusion that only the most highly rated material is useful. A study of the graph in Fig. 2, showing the noise level reductions in our example room when the absorption of the material varies, indicates that the absorbents of low rating produce marked changes in loudness; but as the efficiency of the absorbent increases, there is a diminishing return in the loudness reduction. It takes considerably more absorption to secure the last decibel of sound reduction than the first. Simple calculations will help one to select the right acoustical material in every case.

Other things than absorption, however, must be considered. Since acoustical materials must be exposed to all of the hazards of occupancy, variations in relative humidity in the room, dust, cleaning, and repainting and other conditions, they should also be appraised as one does any interior finishing material.

For example, they vary greatly in appearance from disconcerting ugliness to unobtrusive and even decorative types. From the viewpoint of fireproofing, they are combustible, incombustible or slow-burning. Some materials impose restrictions on redecoration. Some may be cleaned by usual or special methods or painted repeatedly by restricted methods, whereas others may be painted by any method without significant loss of sound-absorbing ability. Generally, those materials that require special painting may be ruined acoustically by casual painting.

Methods of installation

The most common way of applying acoustical absorbents is to fasten them to the surfaces with special adhesives. Some materials are readily nailed in place. Still others can be held in place by a mechanical means that is completely concealed after the job is finished and that shows some economy over placing the material with adhesives, when the plaster ceiling can be omitted.

In acoustical design many factors must be considered. Success on one job does not predict success on another unless all of the conditions which surround each undertaking are identical.

Phoenix Plans a New Airport

John Girand
Johannessen and Girand, Engineers
Phoenix, Arizona

***Contents in Brief**—Faced with the loss of commercial air service because of an inadequate airport, city officials of Phoenix, Ariz., recently developed a plan for an airport which would have the immediate effect of bringing existing facilities up to minimum standards and would also provide for expansion to handle future demands.*

PLANNING AN AIRPORT from base-course to beacon and scheduling construction steps to accommodate present as well as future predicted traffic has been accomplished in Phoenix, Ariz. One of the many cities in the United States caught with an obsolete airport by the technological advances in air transportation during the war, Phoenix (metropolitan area population, 121,828, census of 1940) now has blueprints for building an entirely new air terminal. Principles involved in deriving a complete master plan should be applicable to other localities as the same general procedure can also be used in expanding existing facilities.

When commercial lines refused to land four-engine aircraft at Phoenix because the runway was too short, city officials swung into action and appointed a municipal airport commission, which was charged with planning, building, and operating a new municipal facility. Engineers retained by the commission were given the problem of determining the airport needs of the city and developing a plan to meet those needs, taking into account the emergency situation and estimated future requirements.

The studies were divided into four steps: (1) Accumulating data concerning the required size and layout of the airport; (2) selection of the site; (3) selection of runway pattern; and (4) scheduling construction to meet future demands.

The size and layout of a city airport are dictated by the needs of (1) commercial airlines; (2) commercial aviation activities such as schools, dealers, shops, etc.; (3) privately owned aircraft; and (4) related service facilities such as a coffee shop, news stand, weather bureau, etc.

One index of the needs of the airlines is the number of passengers handled. As the three commercial airlines serving Phoenix regard this information as confidential, the number handled through the Phoenix airport over a recent 12-month period was estimated to be 430,000 based on number of flights per day, size of ships, number of meals prepared and other related data. Commercial airline requirements in regard to runway lengths, end zone clearances, and other pertinent dimensions required for the type of equipment they operate have been published in booklet form by the Air Transport Association of America.

Factors affecting operations

In a city such as Phoenix, important factors affecting airport operations are commercial aviation activities, including flying schools, airplane repair shops, airplane dealers, crop-dusting operators, and instrument repair shops. The needs of this group were estimated in a survey that took into account their present size and their expected requirements for the next five years.

Private aircraft facilities were considered to be an important item in planning the city port. Needs of this group were estimated from the number of private planes now at Phoenix, the number of individuals with private flying licenses in the area, and the number of new planes that are "on order" locally.

It was not overlooked that an airport is a community center. The existing Phoenix airport for example, contains a restaurant, bus terminal, weather bureau, radio station, recreational facilities and similar non-aviation businesses. Estimated growth curves were plotted for each of these items. New enterprises that might desire to operate at the airport were also given consideration, and applications have been received for construction of a hotel, as well as for a barber shop and a bowling alley. Estimated space needs for all these facilities were included in the plans.

Site selection and layout

After these data were assembled, a general conclusion was reached concerning the amount of space necessary for runways, taxiways, administration building, commercial hangars, private hangars and other facilities.

The next problem, that of finding an adequate site, was simplified by the decision that the existing airport location could be used provided almost entirely new facilities were built and the overall area increased some three times. A consideration in this decision was that the old facilities could be used until replaced, one by one, by new and larger facilities.

Furthermore, it was found that the present site has the following advantages: (1) Desirable weather characteristics; (2) freedom from obstructions such as radio towers, hills, high buildings, etc.; (3) low-cost land due to poor agricultural qualities; and (4) a location less than 3 miles from the center of town on a main transcontinental highway, and close to a railroad from which a spur track can be run.

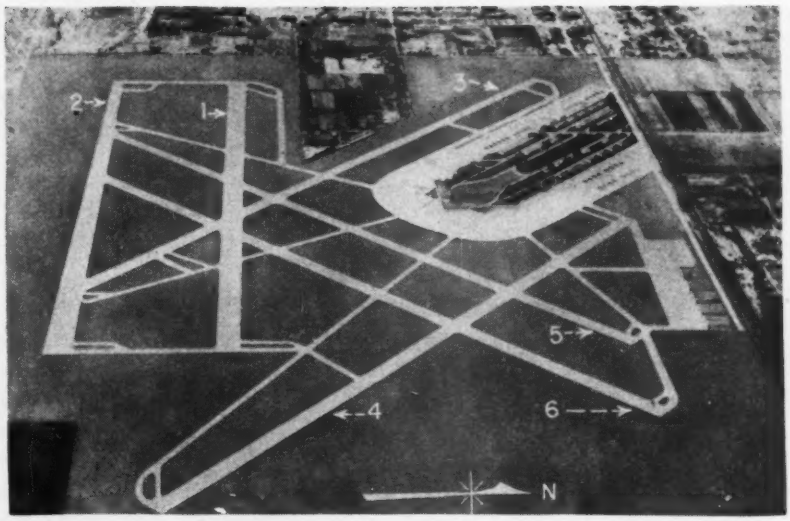
As no "ready made" layout will fit all locations, the next step was to determine the most suitable runway pattern for local conditions. Controlling features at Phoenix were as follows:

1. A manufacturing plant worth $2,000,000 extending into the airport rectangle on the west side.

2. A railroad on the north boundary limiting expansion in that direction.

3. A river on the south. In order to obtain required runway length, runways planned for future construction increments project into the river a short distance. However, other agencies are considering a channel-straightening program that will throw the bank of the river beyond the end of the proposed runways. This work will further minimize flood hazards although these are practically negligible because of the construction of dams on the upper reaches of the river, resulting in almost 100 percent use of available water.

4. Local wind conditions. A wind rose plotted for this location indicated that three runways (east-west, northwest-southeast, and northeast-southwest) would allow aircraft operation 93 percent of the time considering all winds, and 99.6 percent of the time using cross-wind landing for north-south winds less than 15-mph. velocity.



Construction of six runways having a total capacity of 80 planes per hour is called for in the plan developed for the Phoenix, Arizona, airport. The two east-west runways (Nos. 1 and 2) are extra wide for instrument landings.

Master plan adopted

The airport engineers were then able to lay out the airport as shown in the accompanying illustration.

Runways marked 1 and 2 are in the direction of the predominant wind (usable 57.6 percent of the time) and are 7,000 ft. long. Runways 3 and 4 will provide another 22 percent use and are 7,900 ft. and 7,000 ft. long respectively. Runways 5 and 6 complete the necessary coverage and are 7,283 ft. and 7,000 ft. long respectively.

Runways 3, 4, 5 and 6 will be 150 ft. wide. On runways 1 and 2, which will be 200 ft. wide, extra width is provided so they can be used for instrument landings.

Facilities shown in the upper right of the illustration include an administration building, parking space for more than 1,000 cars, commercial aircraft aprons, space for small hangars for private planes, stores, aircraft showrooms, and a hotel. Commercial airline hangars will be located at the right along the spur track. Also near the spur track will be air freight facilities including cold storage and quick freeze units, emphasizing the desire to encourage air shipment of Arizona produce to Eastern markets.

The existing runways (some 6,000-ft. maximum length) have a triangular pattern and are located in the area where the new administration building, hangars, etc. are to be placed. To make the airport suitable for four-motor planes, a contract was let for the extension to 6,000 ft. of the existing east-west runway. This work, scheduled to be completed in September, 1946, will temporarily effect a remedy for the emergency situation. However, this east-west runway will be abandoned on completion of the first increment of construction under the master plan.

Runway No. 3 will have the same location as one of the existing runways but will be longer. Therefore, the first work under the master plan is to include extension of runway No. 3 as well as construction of Nos. 1 and 5 and their taxiways (50 ft. wide); the second step will include runway No. 2; and the third runways 4 and 6.

The parking apron for commercial planes will be built in three similar steps; but other facilities such as roads, spur tracks, private plane aprons, etc., will be included in the first construction program (some of these facilities will be under separate private contract).

On completion of the first increment of construction the field will be capable of handling 40 commercial planes an hour (takeoff and landing). The ultimate capacity will be 80 planes an hour. Work will not be started on the second and third stages until additional capacity is needed. It is expected that the entire project will be finished within 10 years. (By way of comparison, New York's airport at Idlewild will have a capacity of 300 planes an hour. La-Guardia Field's capacity is 400 planes a day.)

Pavements are being designed for 50-ton planes or 25-ton wheel loads. Warm-up pads are subject to full static load plus the vibration load due to the racing engines of fully loaded planes and so are to be made of portland cement concrete as are turning points and loading aprons. Flexible type paving will be used elsewhere.

The completed development will cost about $10,000,000. The initial program contemplates $4½ million of municipally owned facilities while those to be privately owned will amount to $2½ million. Federal assistance in financing is being sought through the Civil Aeronautics Administration. The city's share will come from $1,100,000 of municipal bonds.

The airport is owned and operated by the city of Phoenix, Ariz., and is under the direction of the Municipal Airport Commission, John McAtee, chairman. Engineers for the airport plan are Johannessen & Girand, Phoenix.

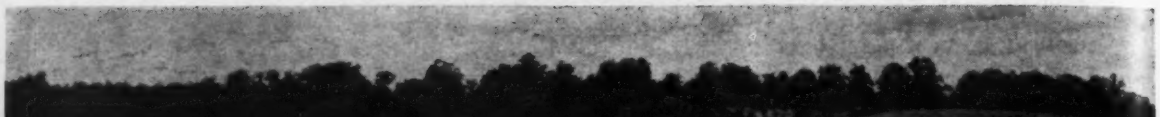


Fig. 1. Dirt flies in Missouri as the state highway department increases the tempo of its construction program.

SIGNIFICANT TRENDS IN

Missouri State Highway Construction

***Editor's Note**—Many significant trends in highway construction in Missouri were encountered on a 950-mile tour of several construction projects throughout the state. Chief emphasis in this year's program is being placed on streamlining construction requirements to combat increased costs and to speed the work. Farm-to-market roads are being improved at a steadily increasing rate.*

WITH $11,695,000 worth of construction already completed or placed under contract by Aug. 1 of this year, Missouri's 1946 highway program is expected to exceed $15,000,000. Some idea of the extent and variety of work can be gained from the table on page 110. It is significant to note that on the primary system, 53 miles of portland-cement concrete had been placed under contract or completed by Aug. 1, at a total contract cost of $2,274,600.

Despite the shortage of structural materials, practically $2,000,000 worth of bridge construction was put under contract during the first seven months of this year. During the same period contracts were awarded for 217 miles of grading and culverts, 110 miles of bituminous surfacing, 60 miles of stabilized base and 125 miles of gravel surfacing.

The over-all construction program for this season is in a healthy position, and shows promise of being substantially increased next year. At the time this was written, the state's construction program appeared to be little affected by OWMR's restrictive order of Aug. 5 or by subsequent rulings of that agency on public-works construction involving federal funds. There seems to be a sufficient supply of contractors to absorb the work as rapidly as it can be placed under contract and, so far, the department has been able to obtain enough field engineers to keep abreast of construction.

Although, during the first part of the season, bids were rejected on nearly one-third of the projects advertised, because of their being over 50 percent above 1940 prices, recent trends in bidding indicate closer agreement between bids submitted and the engineers' estimates.

Much of this is attributed to simplifying the construction specification requirements and removal of as much of the uncertainty in contract bidding as practicable. It is generally believed that the spiraling rise in contract prices is leveling off and that a noticeable reduction in bids on certain items will occur when labor becomes more stable, materials more abundant, and when new and more efficient construction equipment becomes available in greater quantities.

Rolled-stone-base pavement

Typical of one type of low-cost primary highway coming into favor in Missouri, which is planned for rather extensive construction in the future, is a 15-mile stretch of rolled-stone base with asphalt seal now under construction on State Route 100 between Herman and New Haven, Mo. Cameron, Joyce & Co., of Keokuk, Ia., have a contract for the project amounting to $230,000. J. C. Burgesen is project engineer.

This type of construction is applicable where grade and alignment are satisfactory and an old road, with some form of gravel surfac-

ing and ample supporting ability as a subbase, is available. It consists of applying two 3-in. layers of compacted crushed stone, sealed with a 200 to 250-penetration asphalt and surfaced with a coating of limestone chips or pea gravel.

Missouri's rolled-stone-base highways are similar in construction to waterbound macadam roads. In fact, they may be likened to water-bound construction in which the "fines" have been added at the quarry. They are favored over the conventional water-bound macadam pavement as their construction is simpler and there is less danger of getting a wavy surface in the completed pavement.

In constructing a rolled-stone-base pavement, the first operation is to reshape the old roadway surface, clean out the side ditches and compact all existing roadway shoulders with sheepsfoot and rubber-tired rollers. Crushed stone, graded to the requirements that 100 percent passes a 1½-in. mesh screen, 85 percent passes a ¾-in. mesh, 25 to 40 percent passes a No. 8 screen and 15 to 35 percent passes a No. 40 screen, then is windrowed on the center of the highway.

This crushed stone, which is placed in two 3-in. compacted layers, is spread over the roadway with patrol graders to a depth of about 4 in. loose measurement. It is wetted to the proper consistency, manipulated until thoroughly mixed, and spread in final place for compaction. Initial set is obtained with multi-wheel, pneumatic-tired rollers, following which steel rollers are added for final compaction, applying a minimum pressure of 200 lb. per linear inch of width of roller.

Final operations include sealing the pavement with one-quarter gallon of 200 to 250 penetration asphalt per square yard after it has been primed with hot tar, then adding about 40 lb. of pea gravel per square yard to provide a non-skid surface.

No detours required

No detours are required in this type of construction as the road is kept open to traffic at all times. One of the most important requirements is to have the crushed stone wetted to the proper consistency, based on the optimum content for maximum compaction.

In general, maximum compaction

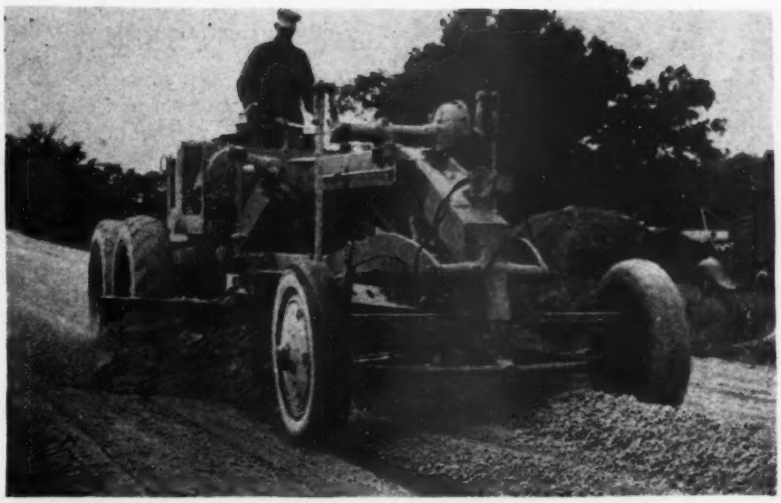


Fig. 2. Missouri plans on improving a large mileage of old gravel roads by adding a 30-ft. wide rolled stone base with a 22-ft. wide asphalt seal. Principal operations include: spreading the saturated crushed rock (top), compacting it with rubber-tired and steel rollers (center), sealing and adding pea gravel (bottom). The pavement is built to a 6-in. thickness over a 20-ft. width.

is obtained when the moisture content is about 5 percent (by weight) of the total mix. Manipulation of the saturated stone is kept to a minimum to avoid segregation of the aggregate.

Width of the rolled-stone base is 30 ft., which ordinarily is the shoulder-to-shoulder width of the reshaped old roadway. The seal coat is applied over a 22-ft. width. In order to provide a proper roadway crown and to avoid raising the existing shoulders, the rolled-stone base is built to a 6-in. compacted thickness over a 20-ft. center width, and feathered to zero thickness at the edges of the pavement. Occasionally, when the subgrade lacks sufficient supporting power, an additional 3-in. compacted layer of rolled-stone base is laid on the subgrade before adding the other two courses.

The state highway department also has found it advantageous, in some instances, to apply about 1½ lb. of calcium chloride per square yard of each course prior to adding the water. Although this does not reduce materially the amount of water needed, it does reduce the amount of compactive effort required.

Construction of rolled-stone-base pavement with bituminous seal and crushed stone or pea gravel surface, in Missouri, costs about three times as much as the conventional clay-gravel roads with asphalt seal, which construction was standard practice prior to this season. And their cost is reported to be about one-half that of portland-cement-concrete pavement.

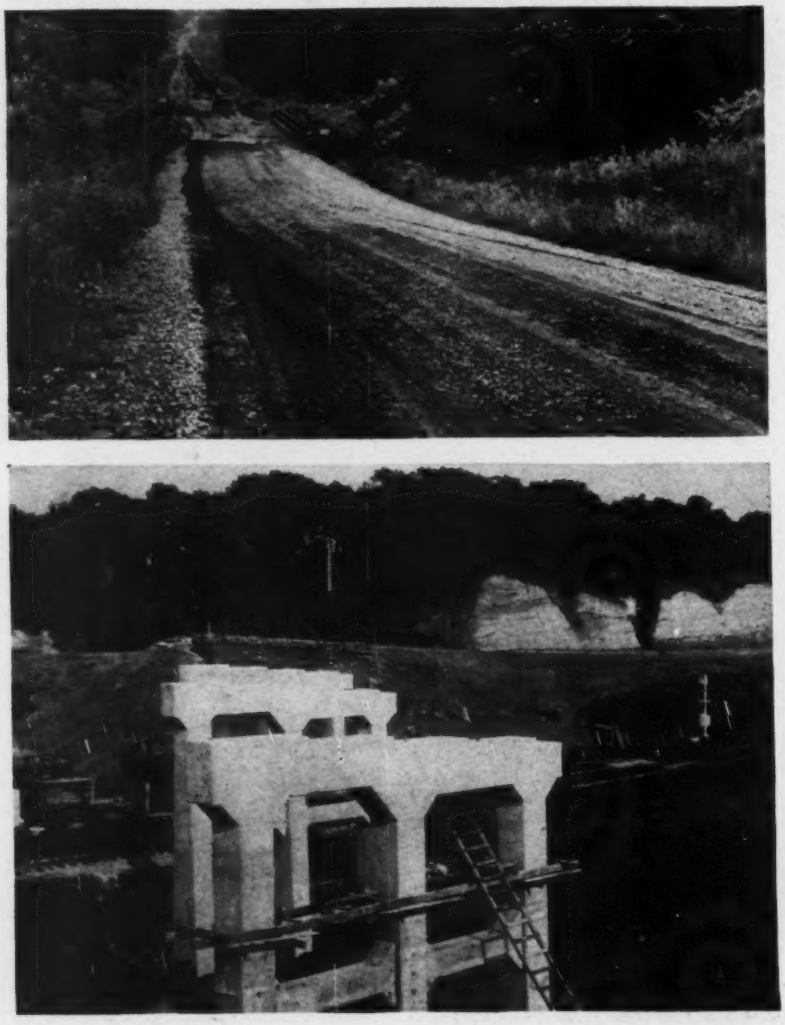


Fig. 3. Supplemental roads vary in standards of construction from the typical farm-to-market road (top), to high-speed expressways and expensive overhead structures in urban areas (bottom).

By reducing the construction refinements as much as possible without sacrificing the quality of work and eliminating as much of the uncertainty in contract bidding as possible, the Missouri State Highway Department is vigorously prosecuting its highway construction program at a cost which is in keeping with current prices of materials and labor.

Perhaps the most far-reaching revision in the state's specifications for the construction of primary and secondary roads is the reduction of earth compaction from 95 to 90 percent of the department's standard compaction requirements. Primarily, this reduces the amount of compaction effort which, in turn, reduces the cost of the work. Moreover, it tends to lengthen the construction season since the reduced compaction required may permit a greater deviation from the optimum moisture content of embankment material. And, in many cases, it precludes the necessity of scarifying, applying additional water and compacting the subgrade material in cuts where the natural material passes the requirements for compaction.

Additional revisions in practices

Other changes in the specifications include an increase in the permissible depth of embankment "lifts" from 6 in. to 12 in. where the material is composed mainly of rock. Considerable hand work has been eliminated through reducing the amount of finishing formerly required on back slopes and fill slopes.

Use of tar paper beneath concrete pavement has been abandoned as the department considers it unnecessary, particularly when a granular subbase is constructed.

In the construction of its farm-to-market roads, the highway department now permits greater tolerances in grading (2-ft. variation in alignment and 0.5 ft. in grade), when such variations are in the interest of economy. This also has proved to be a saving in the amount of engineering work required. The permissible "lifts" in embankment construction involving rocky material has been increased from 12 in. to 3 ft. on farm-to-market roads.

Other important changes in the specifications for construction of farm-to-market roads include the re-

duction of the depth of subgrade scarifying, including the removal of large rocks, from 12 in. to 6 in. This is a point of economy as formerly it cost $25 per 100-ft. station to scarify and compact the subgrade to a depth of 12 in. Also, right-of-way clearing now is confined to roadway limits, *i.e.*, between toe of fill slopes and back slopes of cuts, instead of the entire right-of-way as formerly required.

Reinforced concrete pipe and corrugated metal pipe have been substituted for reinforced concrete box culverts for small drainage structures on the farm-to-market roads, and the final appearance requirements of the completed road have been reduced materially.

"Bricking" requirements reduced

In concrete bridge construction, the amount of "bricking," or rubbing with a carborundum stone, has been limited to the curbs, handrails and outside surfaces of girders. This offers a distinct saving in the cost of bridge construction, particularly on long viaducts in urban areas, since the labor union regulations require this work be done by concrete finishers instead of by common labor. In concrete culvert construction, bricking has been entirely eliminated on handrails and wingwalls. Another expedient in bridge and box culvert construction is to permit use of re-rolled rail steel for reinforcing bars of less than 1-in. diameter.

Two major revisions in the department's standard construction specifications are intended to reduce the uncertainty of the work from the contractor's standpoint. The most important one is the change in the description of a "working day." Under the present ruling, a non-working day not only includes one in which the construction is stopped because of inclement weather, but also includes stoppage of work due to other unwarranted delays over which the contractor has no control. This is particularly appreciated by the contractors during this period of uncertainty in the delivery of construction materials.

The other instance occurs when it becomes necessary to stockpile earth suitable for capping embankment fills and for backfilling rock cuts. Under the old provisions, this work was included in the contract price for excavation; now the contractor receives an additional 60 percent of his unit price for earth excavation for the intermediate stockpiling of this material.

Fig. 4. Earthmoving equipment is parked in single file to expedite servicing at noon and night (top), while major repairs are made on the job in an open-air repair camp (bottom).

So far, the number of contractors bidding on highway construction in Missouri has been ample and promises to continue so for the remainder of this season. What it will be next year when the tempo of the construction program is increased is a moot question.

At one of the department's recent large lettings, involving 46 projects or combination of projects, there was an average of two bids received on each project. The largest number of bids received on a single project was seven.

Of the 46 projects advertised, only one bid each was received on 10, while no bids were received on 11 of the smaller projects. It has been difficult to interest the contractors in the smaller contracts, chiefly because most of them are geared for the heavier work. Then, too, there is a tendency to avoid work involving light grading, which cannot be performed economically with the heavy grading equipment owned by most contractors in that area.

Shortage of labor reported

Contractors report little shortage in skilled labor, generally, but a large turnover in common labor. Despite the relatively high wages paid by contractors, there is a noticeable reluctance on the part of both skilled and common labor to perform a good day's work or to put in as many hours each day as possible even at time-and-one-half pay over eight hours.

On one typical rural job using union labor exclusively, operators of motor patrols, cranes, power shovels and rollers were being paid $1.725 per hour. Operators of tractors and other motor units, except trucks, received $1.55 per hour, while truck drivers and common labor were being

paid $0.90 per hour. Wages paid in urban areas, generally, are somewhat higher.

Distributors of construction equipment in Missouri are reported "booked up" with back orders which will extend well into next year. Tractors, power shovels and earthmoving equipment, especially wagons and scrapers, are in the shortest supply, although there is reported to be a fairly ample supply of concrete mixers, air drills, compressors and pavement breakers.

Form lumber continues to be in critical demand, with no reports being available as to what it costs the contractor when it can be found. Nails also are hard to get, and one contractor reported them to be costing $8 per 100-lb. keg as compared with $3.50 per keg in normal times. Even at this price it is not uncommon for a contractor to send a pickup truck around to local towns to buy nails in whatever quantity possible. On one job the contractor was straightening nails and re-using them over and over.

As of Sept. 1, it required about 18 weeks for delivery of reinforcing steel, with some steel companies refusing to quote prices. Corrugated metal pipe and cement were critical, and delivery dates very uncertain. Numerous small items required in bridge and highway construction were practically impossible to obtain.

TABLE OF CONTRACT CONSTRUCTON TO AUG. 1, 1946
Exclusive of engineering and contingencies

Type of Work	Miles	Contract Cost
Primary system:		
Grading and culverts	100.4	$3,145,500
20-ft. portland cement concrete pavement	1.4	53,700
22-ft. portland cement concrete pavement	46.1	1,755,800
24-ft. portland cement concrete pavement	2.1	99,100
Dual 22-ft. portland cement concrete pavement	3.5	270,800
Dual 24-ft. portland cement concrete pavement	0.7	95,200
10-ft. pavement widening (PCC)	8.5	125,100
Bridges: (36 structures)	.....	1,716,000
22-ft. aggregate stabilized base	17.6	153,100
26-ft. aggregate stabilized base	3.8	40,200
22-ft. cement stabilized base	10.3	83,000
clay stabilized base	1.0	17,500
24-ft. rolled stone base course	27.6	360,900
20-ft. bituminous seal coat	24.6	18,700
22-ft. bituminous seal coat	42.6	91,800
20-ft. bituminous mat	24.6	157,400
19-ft. bituminous concrete resurfacing	16.3	157,000
20-ft. bituminous concrete resurfacing	24.5	280,900
22-ft. bituminous concrete resurfacing	11.8	132,100
24-ft. bituminous concrete resurfacing	33.0	616,900
Oil aggregate surfacing	566.6	694,600
Farm-to-market roads:		
Grading and culverts	117.4	904,300
Bridges (14 structures)	.....	281,600
Gravel surfacing	125.7	274,500
Oiled earth surface	6.2	9,200
Rolled stone base and seal coat	6.2	95,500
20-ft. portland cement concrete pavement	0.8	31,900
22-ft. portland cement concrete pavement	0.7	33,100
Total	1,224.0	$11,695,400

Farm-to-market roads

One of the major enterprises of the Missouri State Highway Department is the construction of farm-to-market roads. Since 1930, when the system was first introduced in Missouri, nearly 8,000 miles of this type of road have been constructed at a total cost of about $49,000,000, or an average cost per mile of about $6,000. As shown in the accompanying table, 117 miles of grading and draining and 126 miles of gravel surfacing had been completed or placed under contract in this year's program up to Aug. 1.

The chief fundamental principle in farm-to-market road construction is to build them as local "service" roads, *i.e.*, to benefit as many users as possible at minimum cost. In accordance with the state's new constitution adopted last year, 50 percent of the funds for the construction of these roads is allocated to counties by a formula based one-half on area and one-half on population. The remaining one-half of the money is allotted at the discretion of the state highway commission. To date, however, more than 75 percent of the funds has been allotted on the first two factors only.

No state road funds are appropriated directly to the counties for farm-to-market road construction as the work is done entirely by the state, and usually by contract. Neither do the counties contribute funds for the construction, although they ordinarily furnish the right-of-way. Each county has a county highway commission, with which the state's division engineers consult as to the order of constructing the roads.

An added impetus to the county road program is foreseen in a recently adopted act of the state legislature, termed the King Milk Route bill. Under this act the state will provide, from general revenue funds, $750 per mile for county road improvement, to be matched by the counties on a 50-50 basis. However, no appropriation has been authorized to date by the legislature for this work.

In determining the degree of necessity for the construction of a farm-to-market road, a reconnaissance survey is made in which is shown every dwelling or public building within two miles of the proposed route. Weighted factors then are applied to each dwelling, farm, school, church and business establishment shown on the survey, and a total is obtained to determine the gross amount of service anticipated by the improvement.

In the case of two possible routes, this system of weighted factors permits a comparison between the potential service of each route with the cost of construction and the probable expense of maintenance. Also, the system enables the state to convince the road users of the wisdom of its final selection.

After a reconnaissance survey has been completed, a description of the proposed route is published in the local newspapers to give all interested parties a chance to voice their objec-

tions. Farm-to-market roads in Missouri are classified in three categories; those carrying less than 50 vehicles per day, from 50 to 100, and over 100 per day.

Cost kept to a minimum

In order to keep the cost of their construction to a minimum, farm-to-market roads are built to a much lower standard than required for main highways. Usually they are built to a 24-ft. shoulder-to-shoulder width. Where it is a matter chiefly of reshaping the road crown, cleaning the ditches and smoothing the back slopes, and does not involve appreciable cuts and fills, the grading is let under a contract price for "machine grading per 100-ft. station." And, in some cases work such as this is done under a contract price for "linear mile grading," or "reshaping existing road."

Bridges and small drainage structures for the farm-to-market roads also are designed for lighter loads and minimum cost of construction. For spans less than 60 ft., the standard bridge usually consists of simple-span rolled steel beams supported on treated timber piling or slender concrete column piers, and carrying a reinforced concrete deck. This type of structure costs on an average of $100 per lin. ft. today, as compared with an average cost of $50 per foot before the war.

Roadway handrails ordinarily are light steel angles on angle-posts instead of the conventional reinforced concrete or heavy channel, angle and pipe rail used on main highway bridges. Width of roadway on these bridges is 20 or 22 ft. Missouri has built no 14-ft., single-lane bridges on even its lowest class of farm-to-market roads, under its postwar program.

Farm-to-market roads are only one type of road included in Missouri's general classification of "supplemental" roads. In fact, supplemental roads vary in standards of construction all the way from the lowest type of farm-to-market road, to the most expensive type of construction found in urban areas. An example of the latter is a one-half mile grade separation project just outside of St. Joseph, Mo., now under construction by the Bushman Construction Co., St. Joseph, at a contract price of $268,000. Perry McGlone, of Kansas City, Mo., is subcontracting the grading and the C. H. Atkinson Paving Co., of Chillicothe, Mo., is the subcontractor on the 26-ft. portland cement concrete pavement. C. F. Brumbach is project engineer.

When completed, this one-half mile of highway will serve as a direct route from the city to Rosecrans Field, used as a U. S. Army air base during the war and now reported as likely to be converted to a commercial airfield in the near future. The highway will cross two main line tracks of the Chicago, Burlington and Quincy Railroad on four 73-ft. continuous steel girders carrying a 26-ft. roadway reinforced concrete deck slab and two 2½-ft. safety walks.

One unusual aspect of this construction project is that nearly all the excavation is a loess material known as "Knox" silty loam. However, it compacts readily in a roadway embankment under sheepsfoot rollers provided the moisture content is from 1 to 2 percent in excess of the optimum required for theoretical maximum compaction. Maximum depth of cut in this loess, which stands readily on a slope of 1 ft. vertical to ¾-in. horizontal, is 87 ft.

Earth excavation

A good example of current grading operations is found in a 10.6-mile project involving heavy grading and the construction of a 24-ft. concrete pavement on U. S. Highway 60, between Mansfield and Mountain Grove, Mo. The Koss Construction Co., Des Moines, Ia., has a contract for the entire project amounting to $703,000 which includes a three-span bridge costing $25,800. Roark and Sons Construction Co., of Anderson, Mo., is subcontracting the grading and concrete work, and R. A. Parsons is project engineer.

The geological formation in this part of Missouri consists largely of Clarksville stony loam containing a heavy red clay and gravel overlaid with 2 or 3 ft. of loam. On this project a 12-in. layer of top soil is being placed under the concrete pavement where red plastic clay is encountered to act as an insulation course in preventing pavement pumping during wet weather.

Despite the rather difficult excavation encountered, the contractor averages 4,000 to 6,000 cu. yd. of excavation per 10-hour day, on an average haul of about 900 ft. To do this, he is using one 8-cu.yd. and one 14-cu.yd. carrying-scraper pulled by large crawler-type tractors; two 10-cu.yd. carrying scrapers, each pulled by a pneumatic-tired, four-wheel tractor and capable of operating up to 20 m.p.h.; two bulldozers; three lighter tractors operating as pushers in loading the scrapers; one rooter with tractor; two sheepsfoot rollers with light tractors; and two motor graders.

Bituminous concrete surfacing

There are some 500 miles of old, narrow rigid pavement in Missouri that need widening and resurfacing. Typical of this work are two projects totaling approximately 35 miles in length, now under construction on U. S. Highway 40 between Booneville and Concordia, Mo.

In this work the old pavement first undergoes an extensive concrete-patching treatment by the state's maintenance forces. Then it is widened to 24 ft. by installing 9 in. of rolled-stone base, in three 3-in. layers, on each side of the old pavement. The top of the pavement widening is built level with the old pavement and the entire surface is covered with a 2½ to 3-in. layer of asphaltic concrete.

Last year, the highway department widened and resurfaced some 60 miles of old concrete pavement, in this manner, on U. S. Highway 66; about 15 miles on U. S. 40 and an equal length on U. S. 61. Cost of the work averages about $15,000 per mile, which includes widening existing drainage structures.

Space does not permit listing the names of all those engineers who contributed to the above information. Included among those who gave generously of their time, however, are: Carl W. Brown, chief engineer; J. J. Corbett, engineer of construction; C. C. Tevis, assistant engineer of construction; V. W. Enslow, bridge engineer; R. P. Cummins, engineer of equipment, and E. G. Elliott, office engineer, construction division. Among the field men interviewed were division engineers B. F. Leslie, L. M. Hoskins, J. L. Brown and H. M. Werbitzky; and division construction engineers J. D. Barber, J. H. Beaven, Wm. Groves, M. J. Snider and W. J. Seaman.

Inventory of Sewage Disposal Facilities

Contents in Brief—A factual measure of progress and trends in sewage disposal facilities in the United States is revealed by the latest Engineering News Record survey, which is patterned after those made in 1935 and 1938 for ready comparison. As in the previous compilations, the data are from official records of the 48 state sanitary engineers, whose interested cooperation made possible this valuable tabulation. An indication of the job ahead in providing needed sewage disposal facilities is given in an appended estimate prepared by the U. S. Public Health Service and state sanitary engineers together with figures on proposed work already reported.

MORE than 1,000 new sewage treatment plants and 1,200 sewer systems were added to the nation's facilities during the war period. This evidence of the advances made during the past seven years in providing more effective sewage disposal facilities in the United States is seen in a survey undertaken by *Engineering News-Record*. Comparison of this survey with a similar one made in 1938 (*ENR* Jan. 19, 1939, vol. p. 98) shows that not only are more treatment plants serving more people, but also that the amount of treatment afforded by these plants has been increased considerably.

The survey, which was compiled from official data furnished by state sanitary engineers, includes for each of the 48 states information on the number of people and communities served by sewers and treatment plants, the number and type of disposal plants, and a detailed tabulation showing the major processes of treatment employed.

Base of survey broadened

In order to broaden its scope and to furnish a more precise picture of actual conditions, the new inventory differs slightly from those made in prior years. Chief among these changes is inclusion in the population and community figures of all incorporated places, both urban and rural, as reported by the 1940 U. S. census. Previous surveys had reported only incorporated places of 2,500 or over. Also included in the new survey is a further breakdown of the ownership of sewage facilities to indicate those belonging to state and county institutions and those under federal control.

This year's inventory reveals that 5,685 communities in the United States have treatment plants serving a total of 47,832,000 people, or over 56 percent of the population living in incorporated places. These figures compare with 52 percent of the population, or 40,884,754 people served by 4,667 plants in 1938.

First place in total number of people served by treatment works—6,617,000—is still held by New York.

In number of communities served by treatment plants Texas still leads the list, with a total of 481. But the number of states having 100 or more community treatment works has in-

State Health Department Officials Who Supplied Data

T. H. Milford	Chief Engineer	Alabama	T. A. Filipi	Dir., Div. of Sanit.	Nebraska
Geo. W. Marx	Director of San. Eng.	Arizona	W. W. White	Dir., Div. of Eng.	Nevada
F. L. McDonald	Chief San. Eng.	Arkansas	Wm. A. Healy	Director	New Hampshire
C. G. Gillespie	Dir., Bur. of San. Eng.	California	H. P. Croft	Chief Engineer	New Jersey
B. V. Howe	Dir., Div. of San. Eng.	Colorado	J. R. Van Duyne	Ch. Engr., Passaic Val. Comm.	New Jersey
W. J. Scott	Dir., Bur. of San. Eng.	Connecticut	C. G. Caldwell	Assoc. Engr., Div. Sanit.	New Mexico
R. C. Beckett	Director	Delaware	C. A. Holmquist	Director	New York
Wm. H. Cary, Jr.	Dir., Pub. Health Eng.	Dist. Col.	J. M. Jarrett	Director	North Carolina
David B. Lee	Chief San. Engr.	Florida	J. H. Lvore	Dir., Div. of San. Eng.	North Dakota
G. R. Frith	Public Health Engr.	Georgia	F. H. Waring	Chief Engineer	Ohio
H. C. Clare	Dir., Pub. Health Eng.	Idaho	H. J. Darcey	Dir., Bur. of San. Eng.	Oklahoma
C. W. Klassen	Chief. Div. of San. Eng.	Illinois	C. M. Everts, Jr.	Sanitary Engineer	Oregon
B. A. Poole	Dir., Bur. of San. Eng.	Indiana	H. E. Moses	Chief Engineer	Pennsylvania
P. J. Houser	Acting Director	Iowa	W. J. Shea	Acting Chief	Rhode Island
Paul Haney	Acting Director	Kansas	J. H. Stevens	Director	South Carolina
F. C. Dugan	Dir., Div. of San. Eng.	Kentucky	W. W. Towne	Director	South Dakota
J. H. O'Neill	Director	Louisiana	R. P. Farrell	Dir., Div. of San. Eng.	Tennessee
J. E. Hale	Sr. San. Engr.	Maine	V. M. Ehlers	Director	Texas
G. L. Hall	Chief Engineer	Maryland	L. M. Thatcher	Director	Utah
A. D. Weston	Chief Engineer	Massachusetts	E. L. Tracy	Director	Vermont
J. M. Hepler	Dir., Bur. of Eng.	Michigan	R. Messer	Director	Virginia
H. M. Bosch	Dir., Div. of Sanit.	Minnesota	E. C. Jensen	Chief Engineer	Washington
H. A. Kroeze	Director	Mississippi	J. B. Harrington	Chief Engineer	West Virginia
W. S. Johnson	Chief of Pub. Health Engr.	Missouri	L. F. Warrick	Sanitary Engineer	Wisconsin
H. B. Foote	Director	Montana	L. Q. Williams	Sanitary Engineer	Wyoming

Inventory of Sewage Disposal Facilities

Compiled by *Engineering News-Record* with cooperation o state sanitary engineers and directors

| State | Population[17] (Thousands, 000 omitted) | | | | 1940 — U. S. Census[16] | | | Communities With Sewerage Facilities | | | | Ownership Municipal Except | | | | | Degree of Treatment Number of Communities Whose Treatment Ends With | | | | |

ewage Disposal Facilities—1945

ngineering News-Record with cooperation of
e sanitary engineers and directors

	Degree of Treatment — Number of Communities Whose Treatment Ends With								Major Processes of Treatment Work — Number of Plants Using																			
	Sewage Farm or Land Disposal		Screening		Primary Treatment Sedimentation through Sludge Disp.		Oxidation including Sludge Disp.								Primary Sedimentation						Filtration			Activated Sludge				
	Without Disinfection	With Disinfection	Without Disinfection	With Disinfection	Without Disinfection	With Disinfection	Without Disinfection	With Disinfection	Coarse Screens	Grit Chambers	Fine Screens	Screenings Shredding, Comminuters	Screenings Incineration	Grease Separation	Total Plants Without Coagulants	With Coagulants Floccul. & Chem. Prec.	Plain Tanks	Mechanical Sludge Removal	Septic Tanks	Imhoff Tanks	Contact Beds	Trickling Filters	Intermittent Sand Filters	Diffused Air	Mechanical Aeration	Secondary Sedimentation	Chlorination
	10	0	0	0	13	0	14	0	4	0	0	0	0	0	27	0	0	0	22	5	0	0	14	0	0	0	
	0	0	0	0	1	1	4	2	0	2	0	0	0	0	15	..	..	1	7	7	..	3	3	....	....	....	
	0	0	0	0	4	0	....	1	2	2	..	1	.	2	7	..	..	2	5	.....	..	....	..	[13]	....	....	
	0	1	42	0	5	0	35	2	19	7	0	1	0	1	31	0	5	16	1	9	0	10	32	1	0	1	
	0	0	1	0	2	3	4	2	8	4	0	2	0	2	11	0	..	5	4	2	0	1	1	4	0	5	
	0	0	1	1	18	12	18	7	39	29	6	13	3	0	29	1	..	24	21	13	0	3	23	2	0	6	2
	10	**1**	**44**	**1**	**43**	**16**	**75**	**14**	**72**	**44**	**6**	**17**	**3**	**5**	**120**	**1**	**5**	**48**	**60**	**36**	**0**	**17**	**73**	**8**	**0**	**12**	**3**
	0	0	2	11	81	110	32	51	238	113	14	17	5	0	273	4	59	99	12	107	2	55	24	9	2	56	17
	3	0	1	2	41	81	12	80	7	7	[15]	..	.	.	204	20	27	54	62	63	3	50	37	7	2	122	13
	1	0	1	0	45	67	15	41	193	12	1	11	0	.	300	0	0	30	104	135	25	123	35	4	6	110	13
	0	0	1	2	51	43	17	8	81	4	2	4	2	11	92	2	31	15	16	32	0	22	5	3	0	18	4
	0	0	0	0	2	6	0	5	8	..	..	..	1	.	11	0	1	2	2	6	..	6	..	....	....	....	1
	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	0	12	1	0	0	0	0	0	0	0	0	
	4	**0**	**5**	**15**	**222**	**307**	**76**	**185**	**528**	**137**	**18**	**32**	**8**	**12**	**881**	**26**	**130**	**201**	**196**	**343**	**30**	**256**	**101**	**23**	**10**	**306**	**50**
	0	0	0	0	21	26	20	33	40	7	0	3	0	1	105	2	13	11	23	58	3	37	6	0	[18]	39	5
	0	0	0	0	32	8	8	6	9	1	0	1	1	0	34	0	..	3	35	15	0	7	0	0	1	6	1
	0	0	0	1	122	5	54	5	113	46	0	15	0	5	178	9	0	31	54	124	0	27	30	8	2	18	1
	0	0	0	0	57	0	18	3	19	15	0	4	0	1	89	0	9	8	43	29	0	15	2	0	4	7	
	0	0	0	0	77	2	11	2	90	29	0	5	0	2	141	3	..	39	60	51	0	33	2	0	0	20	
	0	0	0	1	10	15	4	0	57	2	1	2	0	0	25	0	..	10	2	19	0	4	0	0	0	3	1
	0	0	5	0	77	8	20	16	40	28	0	4	2	2	120	1	..	32	63	25	1	22	3	1	0	19	2
	0	0	0	0	45	6	4	8	8	0	0	0	0	0	63	0	..	2	49	12	1	7	5	1	2	4	1
	0	0	0	0	13	1	15	11	8	6	11	0	0	0	56	0	..	10	12	35	3	27	5	6	3	16	2
	0	0	0	0	31	6	10	25	32	16	0	9	4	0	32	4	..	13	17	38	2	28	1	0	2	28	3
[20]	0	0	0	0	51	4	17	0	17	0	2	4	0	2	71	1	..	14	24	34	0	12	1	1	3	8	
	0	**0**	**5**	**2**	**536**	**81**	**181**	**109**	**433**	**150**	**14**	**47**	**7**	**13**	**914**	**20**	**22**	**173**	**382**	**440**	**10**	**219**	**55**	**17**	**18**	**168**	**10**
	0	0	0	0	67	10	119	5	198	37	2	27	.	6	184	17	14	71	12	104	4	61	30	20	10	80	1
	0	0	1	0	22	0	50	9	31	31	1	14	2	1	78	3	..	32	10	35	1	41	0	12	2	53	
	0	0	0	0	58	12	85	10	175	84	0	54	.	4	288	5	23	96	22	148	0	133	16	13	47	187	4
	0	0	0	0	82	32	87	13	127	31	3	36	.	2	224	9	13	66	12	24	0	77	8	5	23	101	5
	2	0	0	1	55	52	43	13	....	..	1	..	1	.	172	8	2	71	66	34	4	26	19	10	16	8	6
	2	**0**	**1**	**1**	**284**	**106**	**384**	**50**	**531**	**183**	**7**	**131**	**3**	**13**	**946**	**42**	**52**	**336**	**122**	**345**	**9**	**338**	**73**	**60**	**98**	**429**	**18**
	0	0	0	0	96	12	34	71	....	3	4	14	.	2	200	2	2	72	7	121	[21]	95	2	0	10	105	8
	0	0	0	0	32	0	239	10	....	..	..	..	.	.	307	5	2	62	106	141	5	152	112	2	3	101	
	0	0	0	0	62	2	25	0	85	16	0	15	.	3	205	3	11	40	46	108	4	81	13	3	17	81	1
	0	0	0	0	102	1	18	8	32	9	0	2	3	0	112	6	47	9	29	43	4	13	1	1	0	8	
	1	0	0	0	56	0	10	0	28	9	0	2	2	2	69	2	..	9	28	34	0	9	1	1	0	5	
	0	0	0	0	35	1	16	1	40	8	0	2	4	4	73	2	..	10	5	60	0	31	7	1	1	22	
	1	0	0	0	99	0	84	0	18	2	0	30	1	0	103	1	20	13	21	50	0	39	12	2	24	45	
	0	0	0	0	29	0	56	0	79	7	0	7	.	4	168	0	1	32	17	119[18]	5	68	43	9	2	75	
	0	0	0	0	62	3	96	5	173	4	0	4	1	2	166	15	..	27	28	126	3	108	1	1	3	15	
	68	9	12	0	51	0	5	0	65	40	0	4	1	6	462	1	52	12	74	325	..	99	48	<—38—>		88	
	3	0	0	0	45	2	0	0	7	1	0	1	0	0	47	0	4	2	38	3	0	0	6	0	0	0	
[20]	0	0	4	0	12	2	1	0	4	2	0	1	0	0	12	2	..	2	7	5	0	1	1	0	0	0	
	0	0	0	0	25	3	17	10	18	14	0	3	2	2	26	6	..	21	18	19	0	18	1	0	1	3	
	4	0	0	0	29	0	9	0	45	8	0	0	5	0	44	2	..	7	19	20	2	15	0	0	0	4	
	77	**9**	**16**	**0**	**735**	**26**	**610**	**105**	**594**	**123**	**4**	**85**	**19**	**25**	**1,994**	**47**	**139**	**318**	**443**	**1,174**	**25**	**729**	**248**	**20**	**61**	**552**	**2**
																								<—38—>			
	0	0	0	0	23	6	0	0	12	2	0	3	0	0	31	3	26	8	17	9	0	6	0	0	0	5	
	13	0	0	0	37	1	0	2	4	1	0	2	0	0	48	0	0	6	35	[13]	0	6	0	0	0	3	
	4	2	0	0	31	0	4	2	5	3	0	0	9	2	28	4	28	12	19	13	0	6	2	2	2	8	
	4	0	0	0	20	1	0	1	9	10	0	2	1	0	20	2	..	10	9	2	0	0	0	0	0	1	
	0	0	1	0	51	18	5	6	16	5	3	18	.	.	96	4	7	22	53	18	5	20	1	0	5	22	
[20]	0	0	0	0	37	5	11	12	22	5	0	0	1	0	65	0	5	16	36	8	1	15	4	3	0	18	
	7	0	5	1	116	13	23	13	36	8	8	8	1	3	202	9	6	72	60	72	..	59	3	8	0	37	
	33	**2**	**6**	**1**	**315**	**44**	**43**	**36**	**104**	**34**	**11**	**33**	**12**	**5**	**490**	**22**	**72**	**146**	**229**	**134**	**6**	**112**	**10**	**13**	**7**	**94**	**1**
																								<—38—>			
	126	**12**	**77**	**20**	**2,135**	**560**	**1,369**	**499**	**2,262**	**671**	**60**	**345**	**52**	**73**	**5,345**	**158**	**420**	**1,222**	**1,432**	**2,467**	**80**	**1,671**	**560**	**141**	**194**	**1,561**	**1,3**

of effluent.
al, military or war plants
but not under degree of
t. naval or military not
eatment."
served by 1 plant.
. Screens shown are pre-
eatment.

[16] Incorp. Places — 1940 Census used except in New England and N. J. Ark. reports 862 incorp. places; Minn., 780.
[17] Population — 1940 U. S. Census.
[18] Not used: Va., 1 act. sl. pl.; Ind., 4 incin.; Mo., 5 plants, 4 part of treat. (filters), 1 plant abandoned; Kan., 1 Imhoff tank.
[19] Est. 70 percent of this population connected.

[20] Ore.— Does not incl. 18 military facilities. Tenn.— Army, Navy, war inst. not incl.
[21] Magnetite filters.
[22] Does not include: Ind., Cannery waste lagoons and treat. fac. of small slaughter houses; Wis., fiber recovery at pulp and paper mills and disp. syst. at small dairies and slaughter houses.

ENT WORKS

	Aeration	Secondary Sedimentation	Chlorination	Disposal of Sludge: Separate Sludge Digestion	Sludge Drying Beds: Open	Sludge Drying Beds: Covered	Sludge Lagoons	Mechanical Dewatering	Incineration	By-Product Utilization: Fertilizer Production	By-Product Utilization: Gas for Heat	By-Product Utilization: Gas for Power
	0	0	4	0	1	4	0	0	0	1	0	0
.	....	....	....	1	6	1	.	..	..	..	1	...
.	....	....	1	2	2	..	.	..	..	1	2	...
	1	1	1	6	28	1	0	1	1	0	6	0
	5	5	5	4	6	1	1	2	1	0	2	0
	6	25	24	31	17	6	9	5	0	13	0	
	12	**36**	**37**	**74**	**24**	**7**	**12**	**7**	**2**	**24**	**0**	
2	56	172	106	120	99	.	16	6	..	76	10	
2	122	139	74	79	62	5	9	5	..	16	...	
6	110	139	43	194	33	0	1	2	1	[18]	8	0
0	18	46	21	67	2	0	6	2	0	9	0	
..	....	11	4	12	3	.	..	..	..	..	...	
0	0	0	1	0	0	0	1	0	0	1	1	
0	**306**	**507**	**249**	**472**	**199**	**5**	**33**	**15**	**1**	**120**	**11**	
[18]	39	53	13	61	11	0	0	0	0	5	0	
1	6	14	4	9	3	0	0	0	0	0	0	
2	18	11	31	167	1	0	6	0	6	5	2	
4	7	3	11	22	0	1	0	0	2	3	1	
0	20	7	33	84	0	0	1	0	0	11	4	
0	3	17	10	32	0	0	0	0	0	0	0	
0	19	21	31	53	0	0	0	0	0	5	0	
2	4	14	6	13	0	0	0	0	0	0	0	
3	16	29	11	40	0	1	0	0	0	0	3	
2	28	30	19	60	2	0	0	0	0	9	0	
3	8	7	14	39	0	2	0	0	0	5	0	
8	**168**	**199**	**180**	**580**	**17**	**4**	**7**	**0**	**8**	**43**	**10**	
0	80	15	87	158	28	10	9	9	3	68	13	
2	53	9	37	50	13	3	5	[18] 4	1	19	10	
7	187	41	119	247	6	7	10	2	1	91	15	
3	101	50	167	209	3	6	0	2	2	121	19	
6	8	68	67	3	17	.	8	7	..	1	...	
8	**429**	**183**	**477**	**667**	**67**	**26**	**32**	**24**	**7**	**300**	**57**	
0	105	83	72	200	2	1	3	2	1	40	0	
3	101	9	66	308	0	3	2	1	0	57	5	
7	81	17	4	152	1	1	0	0	[24]	24	1	
0	8	6	31	84	0	7	0	0	0	1	0	
0	5	0	7	29	0	1	0	0	0	7	0	
1	22	3	10	55	0	2	0	0	0	10	2	
24	45	0	42	115	0	1	0	0	4	7	0	
2	75	1	8	154	1	6	0	0	0	0	0	
3	15	15	28	153	0	0	1	1	0	5	0	
—>	88	73	52	440	2	13	0	0	2	..	...	
0	0	2	2	42	0	0	0	0	0	0	0	
0	0	2	2	2	0	0	0	0	2	2	0	
1	3	8	21	57	0	1	1	1	2	22	1	
0	4	0	7	39	0	0	0	0	4	3	2	
61	**552**	**219**	**352**	**1,830**	**6**	**36**	**7**	**5**	**15**	**178**	**11**	
—>												
0	5	10	9	17	0	0	0	0	12	7	0	
0	3	9	1	8	0	0	0	0	0	1	0	
2	8	6	15	17	0	1	0	0	4	2	2	
0	1	2	10	15	0	0	0	1	4	6	1	
5	22	47	29	39	3	0	0	0	0	9	0	
0	18	17	21	29	1	0	0	0	0	10	0	
0	37	78	82	135	2	3	1	0	2	28	7	
7	**94**	**169**	**167**	**260**	**6**	**4**	**1**	**1**	**22**	**63**	**10**	
—>												
194	**1,561**	**1,313**	**1,462**	**3,883**	**319**	**82**	**92**	**52**	**55**	**728**	**99**	

lities.

goons
fiber
ayst.

[22] Includes 27 having both separate and combined systems.

[24] None on commercial basis.

[25] 330 communities served by 290 plants. 1 municipality has 13 plants; 1, 4; 2, 3; 9, 2. 68 municipalities or districts served by treatment plants of other

NEW SEWAGE DISPOSAL IMPROVEMENTS NEEDED

	Total Est. Cost of Filling Sewerage Needs U.S.P.H.S. 1944 Thous. $	"Proposed" Sewerage Projects Recorded by ENR Through Sept. 1946 Thous. $	Sewers Only		Treatment Only		Both Sewers and Treatment	
			Places	Population Thous.	Places	Population Thous.	Places	Population Thous.
Maine	$14,070	3,979	200	100	245	300	392	400
New Hampshire	10,830	1,927	...	...	4	50	2	7
Vermont	6,780	1,577	...	...	42[2]	149[2]	25[2]	15[2]
Massachusetts	117,400	65,440	12	226	18	1,074	43	290
Rhode Island	11,960	4,514	...	...	3	62	1	10
Connecticut	17,030	30,101	...	...	8[2]	180[2]	70	...
NEW ENGLAND	178,070	107,538	212	326	320	1,815	533	722
New York	252,230	284,887	[1]	[1]	104	826	298	328
New Jersey	43,210	75,017	...	...	21[2]	675[2]	123[2]	223[2]
Pennsylvania	271,990	174,960	...	...	340[2]	4,509[2]	460[2]	565[2]
Maryland	33,970	24,324	12	14	31	102	12	14
Delaware	6,260	7,884	...	...	8	125	18	19
District of Columbia	26,600	11,602	0	0	0	0	0	0
MIDDLE ATLANTIC	634,260	578,674	12	14	504	6,237	911	1,149
Virginia	44,090	22,702	...	...	70[2]	815[2]	92[2]	47[2]
West Virginia[11]	30,630	15,430	...	...	156[2]	612[2]	36[2]	16[2]
North Carolina	43,040	11,547	...	...	82[2]	382[2]	199[2]	97[2]
South Carolina[10]	19,480	6,335	27	50	20	114	3	13
Georgia	53,650	6,948	...	...	68[2]	548[2]	309[2]	164[2]
Florida	46,030	60,276	...	...	...	...	25	1,030
Alabama[12]	37,860	10,542	8	7	26	308	23	23
Mississippi	28,400	7,206	12	60	8	20	8	55
Louisiana	37,530	21,775	13	24	9	29	33	112
Kentucky	39,800	8,495	177	168	71	653	...	...
Tennessee	59,160	37,791	...	...	68	778	97[16]	44
SOUTH	439,670	209,047	237	309	578	4,259	825	1,601
Ohio	125,450	127,813	...	...	92[8]	1,528	60[8]	100
Indiana	63,340	59,754	...	...	157[13]	825	...	...
Illinois	129,650	191,984	...	...	73[9]	425	313[9]	190
Wisconsin	22,650	25,361	[1]	[1]	80	212	62	48
Michigan	45,070	139,253	...	...	136	1,135	...	...
MIDDLE WEST	386,160	544,165	0	0	538	4,125	435	338
Minnesota	39,120	18,469	...	...	96[2]	223[2]	341[2]	113[2]
Iowa	43,190	14,141	0	0	73	413	110[3]	75
Missouri	81,880	36,321	...	...	51[2]	1,503[2]	405[2]	209[2]
Arkansas	26,630	9,578	0	0	42	161	52[4]	55
North Dakota	12,970	3,243	...	...	...	....	58[14]	30
South Dakota	9,450	2,337	90[7]	32[7]	81	109	121[5]	44
Nebraska	25,790	11,164	...	...	37	275	...	...
Kansas	28,380	7,418	...	...	54	314	171	67
Oklahoma	27,780	15,056	...	...	31[2]	155[2]	275[2]	113[2]
Texas	52,990	99,040	...	...	...	....	212[6]	176[6]
Montana	10,560	6,489	...	...	26[2]	188[2]	46[2]	24[2]
Wyoming	4,830	1,460	34	15	15	50	1	...
Colorado	14,270	2,237	0	0	28	130	8	16
New Mexico	4,580	1,519	0	0	5	19	0	0
WEST OF MISSISSIPPI	382,420	228,472	124	47	539	3,540	1,800	922
Idaho	14,320	2,935	0	0	41[15]	141[15]	65[15]	60[15]
Utah	22,440	12,475	0	0	24	120	18	52
Arizona	3,080	2,520	2	6	10	50	28	58
Nevada	720	1,022	...	1	2[2]	5[2]	...	5
Washington	39,490	33,304	[1]	[1]	65[4]	877[6]	41[6]	166[6]
Oregon	23,450	20,699	...	...	41	451	7	24
California	*131,070	141,240	...	...	57[2]	971[2]	19[2]	34[2]
FAR WEST	234,570	214,195	2	7	240	2,615	178	399
UNITED STATES	$2,255,150	1,882,090	587	703	2,719	22,591	4,682	5,131

[1] New collection systems not approved unless accompanied by plans for treatment facilities.
[2] USPHS report 1944 (Incorp. commun. 200 pop. and over).
[3] Incl. all munic. of 500 pop. or over without sewerage. 30 of these have no water supply.
[4] Incl. munic. of 700 pop. or over that do not have sewerage systems.
[5] Pop. under 400.
[6] Munic. over 500 pop.
[7] Extensions.
[8] Only munic. over 1,000 pop. incl.
[9] Only munic. over 500 pop. incl.
[10] Estimate—accurate inventory underway.
[11] Practically every community needs extensions, rehabilitation or improvement of treatment facilities.
[12] Exclusive of needed improvements to existing plants.
[13] 35 munic. ordered to abate stream pollution, 25 proceeding on own initiative.
[14] Over 400 pop.
[15] Places over 200 pop.
[16] Communities with water supply but no sewerage.

creased from 16 to 22 during the 7-year period. These states are shown in the following table:

Texas	481	North Carolina	187
New York	330	Oklahoma	181
Illinois	327	Michigan	174
Pennsylvania	297	Kansas	159
Iowa	285	Virginia	147
New Jersey	272	Alabama	126
Wisconsin	224	Arkansas	118
Minnesota	210	Maryland	110
California	206	Nebraska	109
Ohio	201	Georgia	107
Missouri	198	Washington	101

Significant in the ownership of disposal facilities are the large increases in privately owned public sewer systems and in industrial waste treatment plants. The first of these probably reflects the inclusion of communities in the 1,000 to 2,500 population bracket in the 1945 survey. The increase in industrial waste treatment plants—from 771 to 1,114—is noteworthy because such installations for stream pollution control were not particularly emphasized during the war years.

Increase in degree of treatment

Other sections of the survey show that some 56 percent of the communities treating their sewage provide primary treatment by sedimentation and sludge disposal. So-called complete or oxidation treatment has been adopted in 40 percent of the communities, but there has been a 100 percent increase in the number of plants employing secondary sedimentation and a 30 percent increase in the number of plants employing chlorination. These large increases reflect the "better treatment" policy generally prevailing throughout the nation during the last few years.

Of particular interest are the figures of treatment types and processes employed, as given in the section of the table headed "Major Processes of Treatment Works." Here are indicated a 24 percent increase in the number of plants using coarse screens, and a 37 percent reduction in those using fine screens. This shift in screening emphasis is further reflected in the methods of screenings disposal, the use of shredding having increased by 331 percent while incineration has decreased 51 percent. In view of the emphasis on separation or recovery of oils and greases before introduction of the wastes to sewers, the 54 percent reduction in the number of plants employing grease separation as a separate process does not seem surprising.

The number of plants using mechanical sludge removal shows a 68 percent gain, and there is a 67 percent increase in plants providing activated sludge treatment. During this same period Imhoff tank installations have shown a 20 percent increase, while septic tanks have decreased 2 percent. In filtration practice trickling filters have forged ahead by 47 percent, while intermittent sand filters gained 7 percent. Contact beds show a 22 percent decrease.

How sludge disposal practice has changed during the period between the 1938 and 1945 surveys is revealed by the statistics, which show that lagooning of sludge and its utilization as fertilizer have dropped off by 14 and 65 percent, respectively. On the other hand, separate sludge digestion is practiced in 1,462 plants, an increase of 73 percent over the 1938 figure. Open drying beds continue to be favored over covered ones for drying digested sludge. Mechanical dewatering and incineration of sludge continue in popularity with increases over the 1938 figures of 51 and 79 percent, respectively.

Sludge gas utilization has made extensive strides since the 1938 report. At that time 542 communities collected the gas, with 51 utilizing it for power production and the rest for heating purposes. The present survey shows that 828 plants utilize this valuable by-product. Of this number 728 use the gas for heating, and 100 for power.

Comparison of these figures on present facilities with those in the accompanying table on "New Sewage Disposal Improvements Needed" shows that 5,685 places have treatment plants serving 46,732,000 people but 7,411 places still require treatment plants to serve 27,722,000 people. In addition, sewer systems are needed by 5,269 places to serve 5,834,000 population.

Estimated future needs, reported by the U. S. Public Health Service in 1944, totalled $2.255,150,000. The extent to which planning has already progressed in an effort to provide for these needs can be realized from the $1,882,090,000 in actual sewerage projects proposed already reported by *Engineering News-Record* through September 1946.

N. Y. Community Tries Off-street Parking Meters

The New York suburban community of White Plains, the county seat of Westchester County, has special traffic problems because some of its main streets are narrow, a number of large New York department stores have established branches there, and the city is a shopping center for most of the county and the southwestern fringe of Connecticut.

White Plains officials believe they have found one solution for their traffic problems in an experiment, begun a few months ago, with municipal off-street metered parking. Mayor Silas S. Clark declares that he thinks so favorably of the plan, which he said was unique in the country, that he is advocating the establishment by state legislative act of a White Plains Parking Authority to rim the entire business area with meter-equipped municipal parking lots.

The mayor said the lots would require virtually no employees. They would limit parking to actual shopping time. The experimental lot has meters adjusted to accept 10 cents for two hours parking.

Objects of the plan are to save streets for increased traffic instead of parking, and to compel residents of other communities to contribute to help defray the cost of local highways and police protection they use.

That the meters can be profitable was indicated by a report from Frank T. Hanlon, Commissioner of Public Safety. A pioneer in the use of meters on the curbs, White Plains derived a profit of $35,000 a year for the first five years after 1938, then suffered a set-back during rationing, but this year is collecting about $50,000 and next year anticipates receipts of $60,000. Mr. Hanlon said the 1,004 meters cost less than $1,000 a year to maintain.

Air Entraining Admixtures Included In PRA Specifications

***Contents in Brief**—Typical of the acceptance being granted air-entrainment in concrete, three commercial admixtures have been approved by the U.S. Public Roads Administration and included in its highway specifications. Information on the chemical composition, action and recommended use of these products is presented here, based on the specifications of the PRA and data supplied by the manufacturers.*

WIDE ACCEPTANCE of air-entrainment for improving the quality of concrete is reflected in the approval that has been given for the use of special admixtures by agencies engaged in large-scale construction, such as the War Department, Public Roads Administration, Bureau of Reclamation, and a growing list of state and city highway departments. Accompanying recent approval by the Public Roads Administration was the inclusion in the PRA specification of three specific admixtures—Vinsol Resin, Darex AEA, and Pozzolith. Since these admixtures must be used properly to achieve good results, some changes in concrete technology attend their incorporation into the mix.

Air improves concrete

Air-entraining agents, according to theory accepted at present, produce minute air bubbles in the concrete during the period of mixing, the action of the agent being that of a foam or froth stabilizer. The tiny bubbles of air are believed to act as "ball-bearings" among the fine aggregates, lubricating the mix and giving it plasticity and workability. This action permits substantial water reduction, makes the concrete easy to place, decreases bleeding and eliminates segregation of the aggregates. In addition, according to one theory, the bubbles are thought to serve as a reservoir into which water, trapped in the minute pores of the concrete, can expand during freezing and thawing and thus avoid the creation of cracks.

While many portland cements themselves accidently entrap about one percent of air, this air does not appear to have the beneficial effects on concrete as that ascribed to purposely entrained air.

An increase in the amount of entrained air, without other change in the mix, usually decreases compressive and flexural strength, and in some cases is said to reduce the bond with reinforcing steel. This is due to the decreased density of the concrete and the increased yield, which automatically reduces the cement content. The desired strength, however, can be maintained by adjustment of the mix design, keeping the same cement content, or by increasing the cement content, the amount depending upon the type of air-entraining agent, while the slump is kept about the same as when no admixture is used. Normal bond strength should be attained.

Fig. 1. One type of admixture proportioner consists of a 3-way valve, a calibrated metering box, air overflow pipe and a reservoir for the air-entraining agent. When the handle is in one position, the meter is filled; a shift shuts off the supply, and the contents are discharged to the concrete mixer.

Marked improvement in resistance to cycles of freezing and thawing has been observed in concrete containing less than seven bags of portland cement per cubic yard when the proper quantity of air has been entrained. When the purposely entrained air content is from 2 to 4 percent by volume of the fresh concrete, entrained air is particularly effective in preventing surface scaling commonly caused by the use of calcium or sodium chloride for ice removal ("Admixtures for Concrete," a report by ACI Committee 212, *Journal*, American Concrete Institute, Nov., 1944).

Agent added at mill or mixer

The first way in which an air-entraining agent was used was to intergrind it with the cement at the mill, but there is a growing tendency to add it to the concrete as a part of the field mix. Of the three admixtures approved by PRA, Vinsol Resin and Darex AEA may be interground with the cement at the mill.

Vinsol Resin, a product of Hercules Powder Co., Wilmington, Del., is a fraction of the natural resin obtained from pine wood, and is characterized by its insolubility in light petroleum fraction. Chemically, it is related to both turpenes and lignins. Its exact chemical composition has not yet been established.

Vinsol Resin is supplied to the user in flake or pulverized form. Since it is insoluble in water and does not become effective in the short mixing time used in the preparation of concrete for addition at the mixer, it is necessary to prepare a solution by neutralization of pulverized Vinsol Resin with a solution of caustic soda. When it is used as an admixture in

the field, the PRA supplemental specification of Aug. 1, 1945, states,

"It shall be prepared on the job for use in concrete by dissolving in a solution of sodium hydroxide prepared in the following manner: Into a steel drum or other watertight container of at least 50-gal. capacity, pour 4 gal. of water; add, with constant stirring, exactly 0.28 lb. of commercial sodium hydroxide and stir until completely dissolved; add to the sodium-hydroxide solution exactly 1.88 lb. of commercial Vinsol Resin and stir until completely dissolved; add to the Vinsol-Resin, sodium-hydroxide solution water to make a total mixture of 50 gal. For each bag (94 lb.) of cement in the concrete mixture, the addition of one quart of the above solution will add Vinsol Resin to the concrete mixture in an amount equal to 0.010 percent by weight of the cement."

The cost of Vinsol Resin in carload quantities is 2½c. per lb. (July 1, 1946) delivered to points east of the Rocky Mountains. Use of about 0.010 percent by weight of the cement is usually adequate.

Neutralized Vinsol Resin has also been made available under the name Vinsol NVX. The material is a dry, free-flowing powder, substantially neutral. Since it is fully saponified, it provides dependable air-entraining action, the manufacturer says. It should be dissolved in warm water for proportioning to the mixer. The cost of this agent in carload quantities is about 5½c. per lb. (July 1, 1946) delivered east of the Rockies.

Tests control air content

In connection with the use of Vinsol Resin, the PRA specifications require that air-entrained concrete shall contain not less than 3 percent nor more than 5 percent entrained air, determined by means of the test for air content, C-138, of the American Society for Testing Materials. Proportions and batch weights for air-entrained concrete are made in the manner prescribed for regular concrete, but adjustments are required to keep entrained air within the specified limits, using the minimum amount of fine aggregate and water that will produce concrete of required workability.

The PRA specifications require that the quantity of Darex AEA to be used be determined by trial. This material, a product of Dewey & Almy Chemical Co., Cambridge, Mass., is substantially a triethanolamine salt of a sulfonated hydrocarbon. Triethanolamine is a catalyst that has been incorporated in Darex to make available more of the inherent strength of the cement, thereby minimizing the loss in strength resulting from entrained air. Darex is furnished in solution ready for use, and is shipped in containers varying in capacity from 5-gal. drums to tank cars.

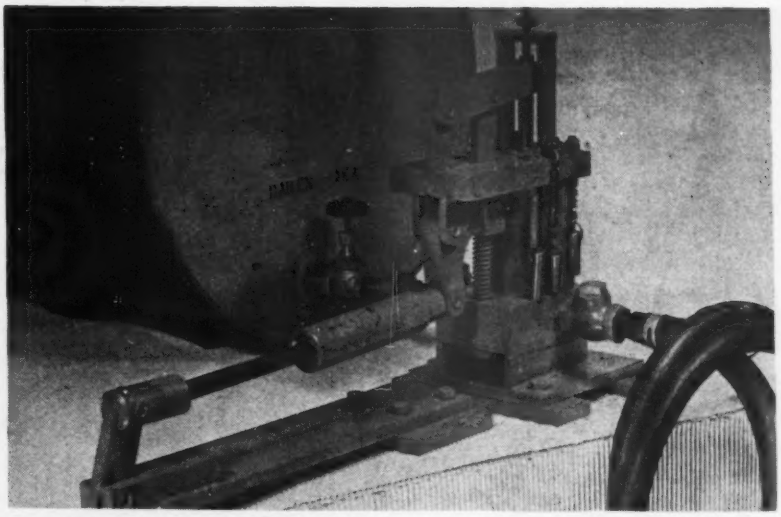


Fig. 2. For use on power mixers, an automatic positive-plunger-type admixture measuring device, developed by Charles R. Watts Co., Seattle, Wash., is operated by a level handle actuated by the skip. The motion is transferred through a bell crank to a vertical plunger, which discharges the admixture into the feed water.

While air entrainment depends upon the amount of agent incorporated, small variations in the amount of Darex used, it is claimed, are not critical and do not greatly affect the percent of air entrained; after the initial mixing, the air content is independent of continued mixing. One fluid ounce of Darex per sack of cement, recommended by the manufacturer for average concretes, will give 3 to 5 percent of entrained air. Larger amounts of agent accidentally added to the mix do not adversely affect the quality of the concrete, according to the manufacturer. The cost of Darex in carload quantities is about 70c. per gal. at the manufacturer's plant. Since one gallon contains 128 oz., at 1 oz. per sack of cement the cost is about ½c. per sack, without further expense for preparation of the agent.

Pozzolith, a product of The Master Builders Co., Cleveland, Ohio, is manufactured in two forms; the insoluble, for use as a dry powder to be added on the job at the mixer, and the soluble for use in central mixing plants. The insoluble Pozzolith is composed of a cement dispersing agent—calcium lignosulfonic acid; an accelerator — calcium chloride; and a small amount of pozzuolanic material. The soluble Pozzolith has the same composition except that the insoluble pozzuolanic material is omitted.

When the contractor elects to use Pozzolith as an air-entraining admixture under the PRA specifications, the amount of agent to be used is that recommended by the manufacturer, namely one pound per sack of cement. If, when Pozzolith is so used, the amount of air entrained in the concrete does not meet the requirement, the PRA specification requires that the material be rejected. However, the manufacturer claims, based on field experience and a series of tests with 13 different brands of cement, that when this proportion of Pozzolith is used, the air content of most normal mixes, regardless of composition or workability, is increased the optimum amount, about 2½ percent.

Pozzolith is admitted to the PRA specifications solely on its air-entraining qualities, although the manufacturer claims a wider action for it as a cement dispersing agent. In this role it is said to break up cement clumps in the mix and hence to distribute the cement particles more or less evenly, subjecting their entire

surface to the hydrating action of the water. The dispersion is believed to result from electrostatic charges on the particles, which cause them to repel one another. When Pozzolith is used, it is claimed, the water previously held in the clumps of cement becomes a part of the liquid medium through which the particles move. Further, by breaking up these clumps the size of the units in the liquid is reduced so that they can move more easily past each other in the fluid.

In some measure, during mixing with Pozzolith, water in the cement paste is replaced by air, though not volume for volume. The result is a more workable concrete at a lower water-cement ratio. Other effects are claimed to be increased fattiness, reduced segregation and bleeding, greater water retentivity and reduced shrinkage before hardening. Also, the concrete strengths are said to follow the water-cement ratio law, so that, for a given cement content, the compressive and flexural strengths are increased, even though 3 to 5 percent of air has been incorporated in the mix.

[Pozzolith is packed and shipped as a fine, dry powder, in waterproof bags containing 50 lb. each, or in air-tight steel drums containing about 400 lb., for overseas shipment or outdoor storage. The standard package, costing about 6c. per lb., is the 50-lb. waterproof bag, and a slight additional charge is made for steel containers.]

PRA approval based on tests

As pointed out by F. H. Jackson, principal engineer of tests, Division of Physical Research, PRA, approval of these three admixtures was based on the following considerations:

"Both Vinsol Resin and Darex AEA have been investigated and approved by committee C-1, ASTM, in connection with their use as interground additions in the manufacture of portland cement (ASTM Specifications C175-44T). We see no reason why these materials should not function equally well when added to the concrete at the time of mixing and have, therefore, approved them for this use. Approval of Pozzolith was based entirely on an exhaustive series of tests made for the Army by the National Bureau of Standards. The results of these tests show that Pozzolith functions satisfactorily as an air-entraining admixture.

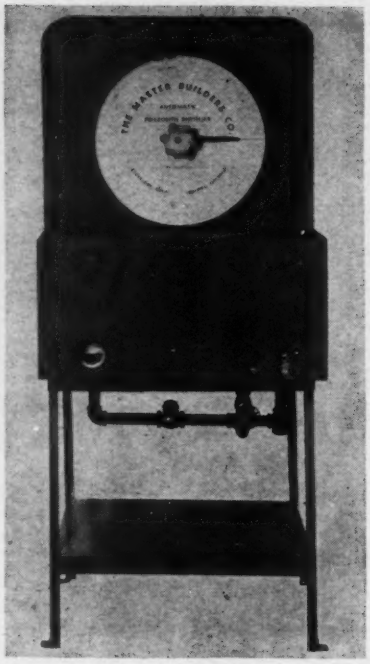


Fig. 3. This button-operated admixture dispenser consists of storage tanks, pump, motor, and measuring device mounted in a metal housing. In operation, the dial is set to amount of cement in the mix and the start button is pushed, delivery being at the rate of two quarts per sack of cement.

"At the present time we know of no other air-entraining admixtures which have sufficient background, either as regards tests or use, to justify approval. If and when such information becomes available, we shall amend our list of approved admixtures accordingly."

AIR-ENTRAINMENT ARTICLES

Other articles in *Engineering News-Record* describing the properties of air-entrained concrete and how to use air-entraining cements have appeared as follows: "Pavement Scaling Successfully Checked," Oct. 10, 1940, vol. p. 471; "Air Content of Concrete," July 17, 1941, vol. p. 89; "Air-Entraining Cement Concrete Proves Scale Resistant," Dec. 30, 1943, vol. p. 950; "Use of Air-Entraining Agents in Concrete," July 13, 1944, vol. p. 57; "Air-Entrained Concrete," Aug. 10, 1944, vol. p. 142; "How to Use Air-Entraining Cements," Aug. 24, 1944, vol. p. 214; "Bureau of Standards Investigates Vinsol Resin Cements," May 31, 1945, vol. p. 775; and "Natural Cement Blend Improves Concrete," July 26, 1945, vol. p. 100.

With regard to the experience of PRA with contractors when admixtures are specified, Mr. Jackson says, "Contractors usually object to the addition of any operation to their construction procedure which is out of the ordinary. However, in so far as the use of air-entraining admixtures is concerned, I feel that as soon as they become familiar with the benefits which, from the contractor's standpoint, are inherent in this type of concrete, they will raise no further objection. These benefits include increased workability, ease of handling and placing, freedom from segregation, and water gain. I believe that contractors will find, as their experience in the use of air-entrained concrete becomes more extensive, that these advantages more than make up for the additional cost of adding the air-entraining agent.

"Some question has been raised as to the difficulty of controlling properly the batch-to-batch additions of very small amounts of admixtures, such as air-entraining agents. However, automatic dispensers for adding such material are being developed and should be available for use in the very near future. I believe that, after the initial uncertainties are out of the way, we shall have no difficulty in controlling concrete properly where the air-entraining agent is added at the mixer."

Durability of concrete

Although the PRA has not yet accumulated data by which to judge the durability of concrete made under its new specifications, Mr. Jackson says, "All of the information which we have been able to obtain regarding the resistance of air-entrained concrete to weathering indicates definitely that durability is markedly improved. Certain questions, of course, still remain. For example, for equal cement content, the strength of the concrete is reduced somewhat. However, in the case of bridges, where the design of the structure is based on crushing strength, I feel that we have, in general, an ample factor of safety to take care of any reasonable reduction in strength. In the case of pavements, the low flexural strength that may result under certain conditions can be corrected by redesigning the mix to obtain the required strength."

Fig. 1. Many Kentucky highways are being relocated and paved with water-bound macadam base, and bituminous surface.

Kentucky Attains Record Road Program Despite Unfavorable Conditions

***Contents in Brief**—Extensive grade-and-drain projects, resurfacing of existing pavement and construction of waterbound macadam pavement form the nucleus of Kentucky's 1946 highway program. Large expenditures allotted to rural highway construction and improvement.*

KENTUCKY'S 1946 highway construction program promises to be the largest in that state's history, both in dollar volume and in miles of highway improved. During the first nine months of this year the highway department awarded contracts for $17,193,000 worth of construction, new surfacing and resurfacing. When completed, this work will provide 1,406 miles of new surfacing and 469 miles of entirely new construction. In addition, $592,000 worth of work was contracted for as part of the program of state aid to counties in rural-road construction.

Ample contractor interest prevailed, throughout more than half the year, with an average of five bidders per contract advertised. As a consequence the department plans to continue to prosecute its highway program as rapidly as the construction industry can absorb the work at reasonable prices.

Waterbound macadam pavement, placed in two 3-in. compacted layers and surfaced with 6 in. of asphaltic concrete, is one of the most popular pavements constructed in Kentucky, both from the standpoint of economy and from the viewpoint of the user. Crushed limestone, used chiefly in the work, is abundant and usually located close to the construction site.

Typical of this work is a 11.2-mile project constructed this season on U. S. Highway 31E, between Hodgenville and Glasgow, Ky. Allen and Codell, of Winchester, Ky., held a contract for the work amounting to $542,600, which also included grading and draining of the new alignment. S. M. Stagg was project engineer and E. M. Allen, Jr., was construction superintendent in charge of the work.

Following the state's accepted practice, where soils of low bearing value were encountered, the first operation upon completion of grading and construction of drainage structures was to apply a 3-in. insulation course of traffic bound macadam, in two applications and bladed to the proper roadway crown. After traffic had been permitted to pass over the new material for a few days, it was reshaped to crown and from ½ to 1 in. of No. 10 screenings added, following which the material was wetted and compacted with 10-ton, three-wheel rollers for two or three days until thoroughly bonded.

Next, the first 3-in., or subbase course of waterbound macadam was added using crushed stone graded from 2 in. down. Ordinarily, this stone is spread with an asphalt paving machine, then rolled to crown and profile and until well keyed. A layer of No. 10 screenings then was applied with a chip spreader, with 10-ton rollers following close behind to compress and vibrate the screenings into the voids in the subbase.

Rollers were equipped with hydraulically operated stiff wire brooms to insure uniform application of the screenings and to sweep them down into the voids. Water was added in

"copious" quanities and rolling continued until the entire mass set up as waterbound macadam.

After an interval of about three days, the second, 3-in., or base course, of waterbound macadam was constructed, which was a duplicate of the subbase course. Each 3-in. compacted course of waterbound macadam required on an average of 36 tons of crushed stone per 100-ft. station of 23-ft. pavement. A well-equipped and efficient crew can lay and compact about 600 tons of crushed stone per 8-hr. day.

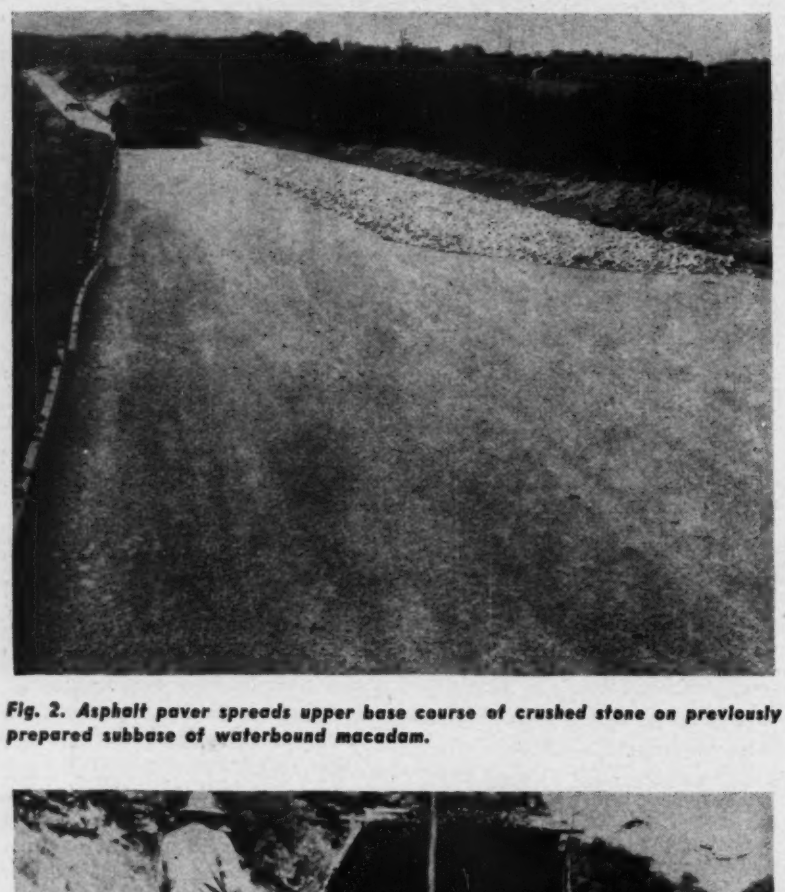


Fig. 2. Asphalt paver spreads upper base course of crushed stone on previously prepared subbase of waterbound macadam.

Fig. 3. Old macadam pavement receives new surface of 1½-in. bituminous binder and 1 in. of hot-mix bituminous surfacing.

Asphaltic concrete surface

After the waterbound macadam base had become thoroughly dry it was given a prime coat of ¼-gal. of RT3 refined tar per square yard. Then a 22-ft. width of hot-mix bituminous concrete pavement was added by conventional methods, consisting of 3½ in. of base course and 2½ in. of combined leveling and surface courses. This high-type, durable pavement costs on an average of $35,000 per mile, including grading and construction of small drainage structures.

Resurfacing of existing highways with bituminous material is one of the department's major activities. Contracts for this work, in general, are awarded in groups as a point of economy for both the contractor and the state. This procedure minimizes the cost of moving men and equipment onto the job and enables the state to interest the larger contractors in the work. It is not uncommon to group as many as 15 resurfacing projects in a county, under one contract.

Typical resurfacing project

Typical of the resurfacing program is a 21-mile project started about July 1 on State Route 30 running east from East Burnstadt, Ky. Breslin Construction Co., Louisville, Ky., held a contract for the work, amounting to $176,500. James M. Lucas was resident engineer on the job.

On this project, specifications called for the application of a prime coat of 0.5 gal. of hot tar per square yard of old traffic bound macadam. This was followed by a 1½-in. binder course and a 1-in. surface of hot-mix bituminous material, each course being rolled to the proper compaction. Best results were obtained by applying the prime coat in two passes—0.35 gal. per sq. yd. the first time and 0.15 gal. later. The first application of prime coat was kept about six miles ahead of laying the bituminous macadam, while the final application (0.15 gal. per sq. yd.) was made about one day ahead of the paver. Using a crew of 25 men, which included eleven truck drivers and a crew at the traveling asphalt plant set up near the end of the job,

the contractor laid about 600 tons of bituminous material per day.

Rural county highways also constitute an important task for the highway department. Under the new appropriation of $5,000,000 authorized annually for rural highway improvement by the 1946 state legislature, the department is obligated in the maintenance of 10,230 miles of county roads. In addition, it has agreed to assist in the construction of 1,090 miles of new all-weather routes. About 10 percent of all the mileage contracted will be in new roads, representing 25 percent of the funds available.

In counties having registered engineers the state will supply the materials, with the counties handling the work. About 860 miles of county roads will fall into this category. Construction projects involving county highway improvement also are grouped in sufficient numbers to make a seasons's work for the contractor and thus make it worthwhile for the large contractor organizations to engage in the work.

Large grading contracts

Three large grade-and-drain projects started early this season will do much to improve U. S. Highway 27 between Cynthiana, Ky. and Cincinnati. Subsequent contracts will provide for placing waterbound macadam and concrete pavements on the 21.3 miles of new alignment.

The first contract, amounting to $341,600 is held by W. C. Snider, Danville, Ky., and covers six miles of new highway involving 421,000 cu. yd. of excavation at a contract price of $0.44 per cubic yard. Codell Construction Co., Winchester, Ky., has the second contract, for 3.6 miles of new highway. It involves 310,000 cu. yd. of excavation at $0.48 per yard.

The third contract, which is one of the largest grade-and-drain contracts let to date by the Kentucky State Highway Department, provides for 11.7 miles of new highway and involves 753,500 cu. yd. of excavation at a contract price of $0.38 per cubic yard. The first two projects are scheduled for completion this year, but the completion date for the third has been set for June, 1947.

The high point in the bridge department's activities this year was the opening to traffic, on Aug. 17, of the 1,736-ft. long, $1,400,000 bridge over the Kentucky River at Clay's Ferry. Said to be the highest, continuous steel deck-truss bridge in this country, its roadway is 250 ft. above the normal river level.

Contracts totaling $3,168,500 have been awarded this year for the construction of 15 major bridges throughout the state. On Aug. 30 the state-owned bridge at Livermore, Ky. was made toll free, leaving only two bridges in the state still collecting toll, one at Rockport, Ky. and the other at Milton, Ky.

All construction of the Kentucky State Highway Department is under the jurisdiction of G. R. Logue, director of construction, assisted by J. S. Hill and O. W. Edwards. T. H. Cutler is state highway engineer, and J. Stephen Watkins, state highway commissioner.

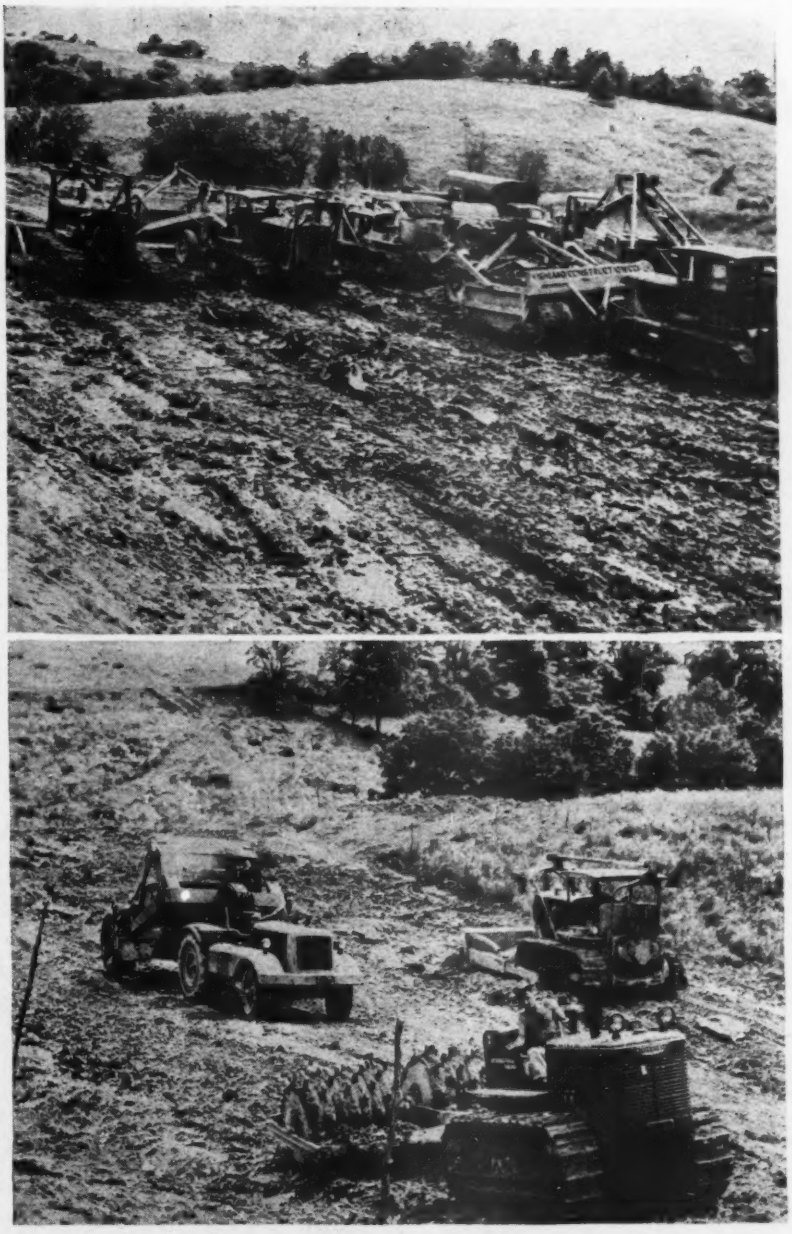


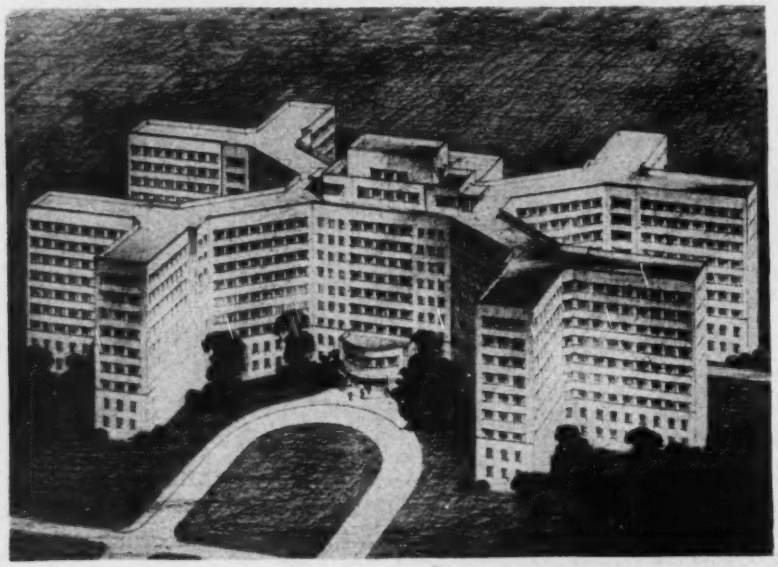
Fig. 4. Heavy construction schedule requires the concentration of several earth-moving units in a small working area (top). Bulldozers, sheepsfoot rollers and rubber-tired scrapers work in unison to compact the base of a large embankment (bottom).

Design Criteria for Veterans' Hospitals

***Editor's Note**—Because the design of hospitals to be built under the current construction program of the Veterans' Administration is to be put in the hands of private architects and engineers, it appears to be desirable to set forth briefly the design criteria that are to be applied in that work.*

BASED upon detailed studies of actual layouts, criteria have been developed by the Veterans Administration for the three types of hospitals to be built so extensively in that agency's $800,000,000 construction program.

Available at present are requirements for eight sizes of general medical and surgical hospitals, namely, those of 100, 150, 200, 250, 300, 500, 750 and 1,000 beds. Criteria for 250- and 500-bed tuberculosis hospitals, 500- and 1,000-bed neuropsychiatric hospitals and a 300-bed domiciliary development have also been prepared.



A typical Veterans Administration 500-bed general medical and surgical hospital proposed for construction in large cities is shown above and a 1,000-bed general medical and surgical hospital below.

In outlining requirements for a general hospital, architects and engineers of the Veterans Administration point out that consideration must be given to the fact that the operation and function of a veterans hospital differ greatly from those facilities planned for civilians mainly because of the length of hospitalization of patients. The average patient stays about 9 days in civilian hospitals as compared to about 38 days in a veterans hospital. As a result of this long period of hospitalization, such additional facilities are required in veterans hospitals as dining rooms for ambulatory patients (often 50 percent of the total patients), rooms for religious, vocational and administrative activities, a gymnasium for psychoneurotic patients, and other provisions for recreational and rehabilitation.

The hospitals will in general be self-contained, with a central heating plant, adequate laundry facilities and sufficient storage space, subject to individual study of each location. In the layout of the hospitals, consideration must be given to the fact that only about two percent of the patients will be female, with no obstetrical cases to be handled. To provide all these facilities, the larger general hospitals, which will be built in big cities where sites will be generally limited in area, may of necessity have to be of multi-story construction.

In the tuberculosis and neuropsychiatric hospitals, additional factors must be considered. For example, in the design of tuberculosis hospitals, a wholesome, homelike atmosphere and privacy of the patient are important. Since the sites for these hospitals will vary from 15 to 20 acres in area, with some as much as 150 acres, the spread-out type of plan may be used.

Porches opening off bedrooms are not only not necessary in the treatment of tuberculosis, but they are objectionable because they intercept light to rooms below, add to the difficulty of controlling patients, and call

for a large initial investment. Depending on local and climatic conditions, canopies are suggested for over windows on the sunny side of the buildings of the tuberculosis hospitals. Venetian blinds or shades are optional.

The generally required areas for the major components of a few typical veteran hospitals are given in the accompanying table. It should be noted that these areas are approximate only and that the totals do not include corridors, stairs and elevators.

Minimum requirements listed

Minimum general dimensions require that in all types of hospitals the width of corridors be at least 8 ft., and that the minimum floor-to-floor heights in the upper stories be 11 ft. The minimum permissible size of single bedrooms has been set at 120 sq. ft., and the arrangement of the wards must provide not less than 70 sq. ft. per bed. In addition, in the tuberculosis hospitals, the width of the individual bedrooms must be at least 11 ft. to permit adequate working space around the beds. Minimum sizes are also being specified for toilets, bathrooms, quarters for nurses and internes, and reception and waiting rooms.

The frame work of most of the structures is expected to be of skeleton type, although the designer will be free to specify whether steel or reinforced concrete is to be used.

The most satisfactory type of lighting for the various areas will be determined in the preparation of detailed plans for a specific project. It has, however, been specified that adequate facilities for standby lighting and power be provided to operate a given hospital for a period of at least four hours in case the regular power supply is interrupted.

Started before the big Veterans Administration construction program got under way, a 1,172-bed neuropsychiatric hospital at Tomah, Wis., is now nearing completion. Here shown is but one of the many units in the hospital.

Air conditioning requirements

With all three types of hospitals, air conditioning will be provided for the operating suites, X-ray departments, central supply sections, and post recovery units. Also, in the neuropsychiatric hospitals, partial air conditioning is planned for the seclusion rooms, the individual rooms planned especially for patients in an allergic condition, and all necessary darkened working areas, such as film rooms.

In developing detailed plans for tuberculosis and neuropsychiatric hospitals, much larger automobile parking areas must be provided as part of the projects than would be required with civilian hospitals. This condition prevails because many of the patients to be accommodated in the hospitals of these types will receive treatment for long periods, and the Veterans Administration plans to provide for the maximum number of visitors as part of the recreational program for the patients.

The criteria outlined were developed under the direction of F. S. Dryden, assistant administrator for construction, real estate and supply of the Veterans Administration, and J. J. Rockefeller, director of construction for the administration. Construction of most of the veterans hospitals and preparation of the detailed plans is being carried out by the U. S. Army Engineers under the general direction of Brig. Gen. John S. Bragdon, chief of military construction for the corps. The Army Engineers are employing private architect-engineers on the projects turned over to them to build (*ENR* Feb. 21, 1946, vol. p. 265).

REQUIRED AREAS FOR VETERANS HOSPITALS

General Medical Hospitals

	Administrative sq. ft.	Professional sq. ft.	Nursing sq. ft.	Service sq. ft.	Total sq. ft.
200-Bed	29,000	19,000	52,000	19,000	119,000
500-Bed	38,000	49,000	94,000	41,000	222,000
750-Bed	73,000	58,000	156,000	54,000	341,000
1,000-Bed	75,000	64,000	214,000	79,000	432,000

Tuberculosis Hospitals

250-Bed	42,000	33,000	71,000	43,000	189,000
500-Bed	51,000	43,000	143,000	45,000	282,000

Neuropsychiatric Hospitals

1,000-Bed	44,000	72,000	245,000	118,000	479,000

NOTE: Corridors, stairs and elevators are not included in areas listed above.

Charts for Canal Flow Computations

G. G. Commons and L. B. Griffith
Office engineer, State Board of Water Engineers, and Consulting Engineer, respectively, Austin, Tex.

IN THE STUDY and design of the trapezoidal canals used so frequently in highway and drainage work the engineer must often investigate several combinations of factors, of which each has limiting values. And yet, so far as is known no simple graphical method of solving this type of problem has been published. This condition exists despite the fact that some of the factors involved are assumed and are only approximately correct, so that graphical solution is sufficiently accurate for all practical purposes. The accompanying charts should be of real value, therefore, in speeding up solution of canal flow problems.

In constructing the charts the Manning formula was used in the form

$$Q = Av = A\frac{1.486}{n}r^{\frac{2}{3}}s^{\frac{1}{2}}.$$

The value of $n = 0.03$ was used in computing the flow and velocity, but the curves can be used for other values of n by changing the flow and velocity in the ratio $n/0.03$. Also, although the curves give solutions for slopes ranging from 0.001 to 0.03, they can be extended to include a wider range of slope values, or can be used for other values of s by using $s = 0.001$ on the curves and changing flow and velocity in the ratio $(0.001/s)^{\frac{1}{2}}$.

Two sets of water depth curves

Each chart gives two sets of water depth curves. It should be noted that the horizontal line through any bottom width is combined with the desired water depth curve on the right to determine flow, and with the one on the left to determine the corresponding velocity. The horizontal lines, representing various slopes, are combined with the diagonal flow and velocity lines; the vertical lines equating these two groups of variables serve only as guide lines when using the charts.

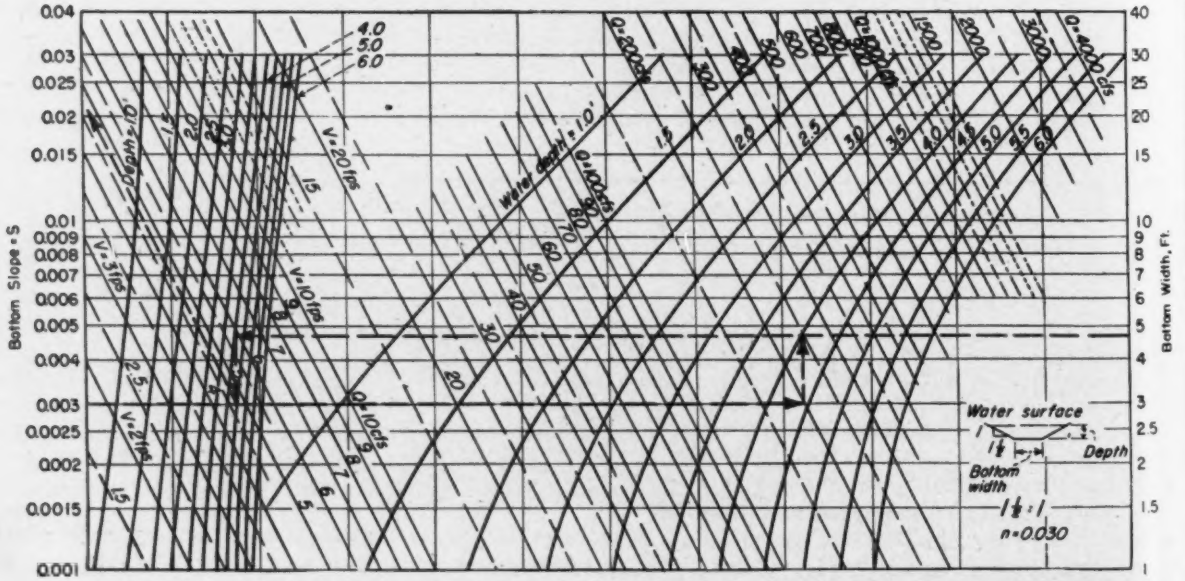
Four simple examples serve to illustrate the use of the charts:

Example 1—Given a flow, $Q = 200$ cfs.; a slope, $s = 0.003$; and a water depth of 4.0 ft. Assume $n = 0.030$. Find the bottom width of a trapezoidal drainage ditch with side slopes of 1½ to 1. Also find the velocity.

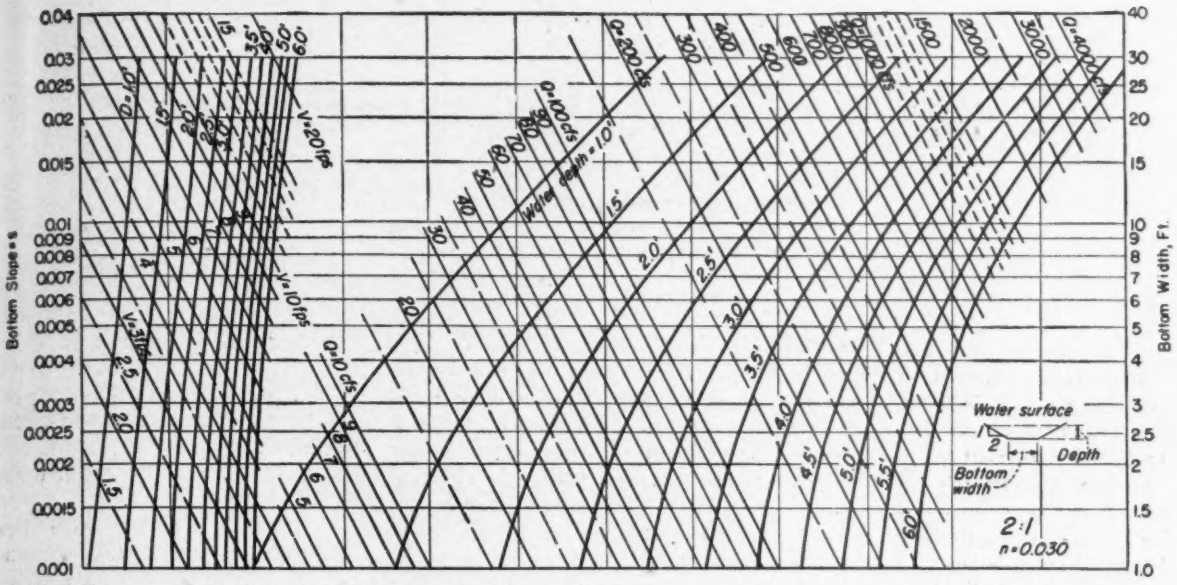
On the chart for 1½ to 1 side slope find the intersection of the horizontal line for $s = 0.003$ with the diagonal flow line $Q = 200$ cfs. From this point proceed vertically to the intersection with the 4-ft. depth curve on the right side of the chart. The horizontal line through this point gives the desired bottom width as 4.7 ft. Where this same bottom width intersects the 4-ft. depth curve on the left side of the chart, follow a vertical line to the slope $s = 0.003$. This will give a point on the required velocity curve, $v = 4.67$ ft. per sec.

Example 2—Given $Q = 200$ cfs., $s = 0.003$, and a desired velocity of 4.67 ft. per sec. Assume the same n and drainage ditch as in Example 1.

Proceed as before with a trial value



Inter-related flow and velocity curves provide easy graphical solution of problems involving trapezoidal canals.



Curves for trapezoidal canal flow can be adapted to other values of n and s by simple conversion ratios given in text.

of water depth and note the velocity. By increasing or decreasing this value the desired velocity is found as in Example 1 and the corresponding values for water depth and bottom width are seen to be 4 ft. and 4.7 ft. respectively.

Example 3—Use of the chart for values of n other than $n = 0.03$. Given $Q = 100$ cfs.; $s = 0.003$ $n = 0.06$, and a water depth of 4.0 ft. Assume same side slopes as above. Find the bottom width and velocity.

As shown above, the value of n only affects the value of the flow and the velocity in the charts. Since $n = 0.06$, the value of Q to use in entering the chart is:

$$Q_c = (n/0.03)Q = (0.06/0.03)Q = 200 \text{ cfs.}$$

Entering the chart as before with $Q_c = 200$ cfs., the bottom width is found to be 4.7 ft. and $v_c = 4.6$ ft. per sec. Therefore, from the formula

$$v_c = 4.6 = (n/0.03)v$$

v is found to be 2.3 ft. per sec.

Example 4—Use of the chart for values of s other than those given on the chart. Given $Q = 100$ cfs.; $s = 0.00025$; $n = 0.03$, and a water depth of 4.0 ft. Assume same side slopes as above. Find the bottom width and the velocity of flow.

Since $s = 0.00025$ is not given on the chart, the equivalent flow, Q_c, to use in connection with the slope line $s = 0.001$ on the chart is:

$$Q_c = (0.001/s)^{\frac{1}{2}} Q = (0.001/0.00025)^{\frac{1}{2}} Q = 2Q = 200 \text{ cfs.}$$

Entering the chart as before with $Q_c = 200$ cfs., and using the slope $s = 0.001$, the bottom width is found to be 10.5 ft. and the velocity $v_c = 3$ ft. per sec. Therefore, the velocity is found from the formula

$$v_c = 3 = (0.001/s)^{\frac{1}{2}} v = 2v$$

and $v = 1.5$ ft. per sec.

City Official Believes Underground Parking Would Pay For Itself

The downtown parking problem of Memphis, Tenn., may be solved, it is said, if City Commissioner Boyle's plan goes through to provide parking for at least 3,000 cars underground.

This is what Mr. Boyle proposes:

1. Excavation for underground parking lots of three stories each beneath the present fire department headquarters at Front and Union, Confederate Park, and on the city-owned parking lot. Each area is a block square.

2. Excavation for an underground parking area beneath Front Street from Jefferson to Gayoso, which also would be a lateral artery for connecting the three major underground lots.

3. Auto entrances and exits for the entire system in the sides of the river bluffs on the slopes of Union, Monroe, Court and Jefferson between Front Street and Riverside Drive, by means of ramps. In the one-way traffic system, cars would enter from one side and depart from the opposite.

4. Street entrances and exits for pedestrians, by means of stairs, on the east side of Front Street from Jefferson to Gayoso; also pedestrian tunnels direct to office buildings and department stores facing Front Street so that autoists can walk directly into them.

"It may sound fantastic, but it isn't," said Mr. Boyle. "With the tremendous increase in the number of automobiles in the next few years something will have to be done to solve the downtown parking problem, and placing these cars underground is the only way to do it.

"The cost would not be much. The city already owns the properties, and the only major item of expense would be for excavation and concreting.

"The entire project would be owned and operated by the city and, at a reasonable parking fee, I am sure it would pay for itself in 10 years. Our parking meters, installed a few years ago, paid for themselves in their first nine months of operation."

Fifteen-Year Experience Proves Efficiency of Garbage Incinerator

***Contents in Brief**—In an incinerator at Spokane, Wash., originally designed for grates in which to preheat garbage, coupled with ingenious mechanical improvements developed as needed, have made for a high degree of success in a 15-year operating record. Now heavily overloaded, the plant is soon to be replaced by another of greater capacity using the same design.*

SPOKANE has cause for pride in its garbage incinerator, operated by what the city charter quaintly calls the "crematory department." While other cities have struggled rather unsuccessfully with many garbage difficulties Spokane has employed home talent to design its own incinerator and has met any difficulties of operation so successfully that there is now a 15-year record of highly satisfactory operating experience.

As the city has grown under wartime industrial development and the load on the garbage incinerator has increased, it becomes necessary to provide additional capacity. This is being done by making plans for an entirely new plant in which will be used the highly successful original design plus numerous improvements that have come from experience.

A description of the original plant and the method of operation appeared in *ENR* Feb. 20, 1936, vol. p. 277. When the plant was revisited recently by the same staff editor who wrote the article of 10 years ago, the same equipment was found still in operation. However, the plant had obviously benefited by the supervision of a mechanical genius in the person of the superintendent of the "crematory department." Under his sympathetic eye numerous changes and improvements in the operating machinery had been made as years of experience showed the way to more efficient operation.

Automatic loading equipment

Perhaps the most notable addition to the original equipment is a pair of elongated bins in a building adjacent to the original charging floor. Normal operating procedure now calls for garbage trucks delivering to these bins instead of dumping directly into the bins over the furnace. Each of these bins, about 6 x 28 ft. in plan, has a capacity of some 32 cu.yd. below the floor level. The rear and sides of the bin form a movable wall unit which can be slid forward, by mechanical means, slowly forcing the contents of the bin out of the forward end where it falls upon a belt conveyor.

The movable portion of the bin and the belt conveyor are controlled by an interlocked mechanism, which the operator uses to maintain the desired rate of delivery to a charging skip. This skip, also operated by remote-controlled motors, contains the proper quantity for one charge to the basket grates. At desired intervals the skip is lifted and dumped into the charging bin immediately above the basket grates. This charging bin likewise has remote controls at the operator's station on the stoking floor where progress of burning in the grate chamber is watched closely and is maintained by appropriate operation of the various feeder mechanisms.

As garbage arrives at the plant the trucks are directed to appropriate destinations. The most direct delivery is to the charging floor above the basket grates. Here the trucks can dump directly into bins over the grates. Sometimes trucks are directed to this spot to deliver part of the load into the bin while a portion, perhaps some combustible material useful for starting or speeding up the fires, is set aside for later use.

Since 85 percent of the garbage is charged through the storage bunkers, the trucks usually go to the room adjoining the charging floor and deliver to the bins with the movable walls. Here the garbage can be held as long as desired and fed intermittently, if need be, without delaying the trucks.

In this feeding operation from bins to belt, a novelty of special design has become a highly essential part of the operation. This consists of a "feeder" mechanism which operates

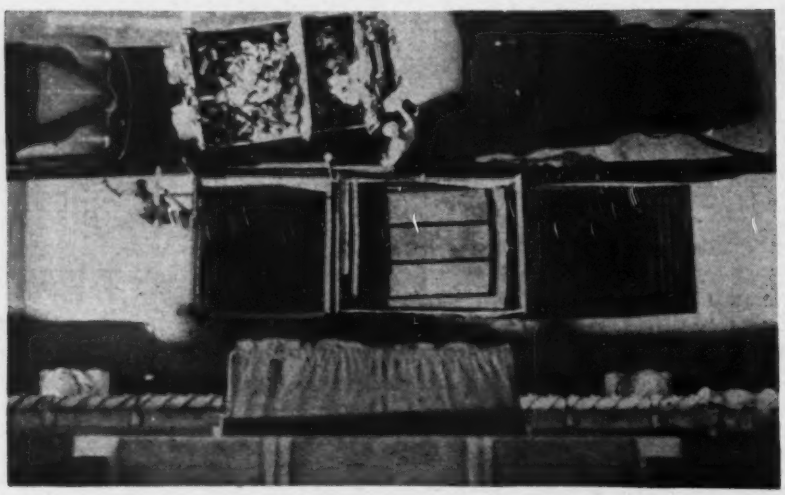


Fig. 1. Birdseye view of a Spokane garbage truck with vertical partitions between non-combustibles at the rear and garbage proper in front.

continuously as the contents of the bin are thrust forward to fall on the belt. It is located in the outlet of the bin just above the belt and functions as a reciprocating fork thrust into the advancing face of the garbage in such a way as to regulate and make more uniform the rate of discharge.

Essentially this mechanism is a set of steel bars resembling the fingers of a finger-lift truck. However, the extreme outer end of each finger, for a length of 4 or 6 in., is hinged so that these finger tips can bend or swing upward, thus preventing danger of wedging material on the down stroke. Another safety feature is the plate of steel closing spaces between the finger bars at the rear end. This plate was added after operation had shown the necessity for some means of preventing rigid material from being caught and wedged between the base of the fingers. This feeder mechanism is electrically interconnected for automatic operation whenever the belt is being loaded. It is credited with the success of garbage feeding by the methods here employed.

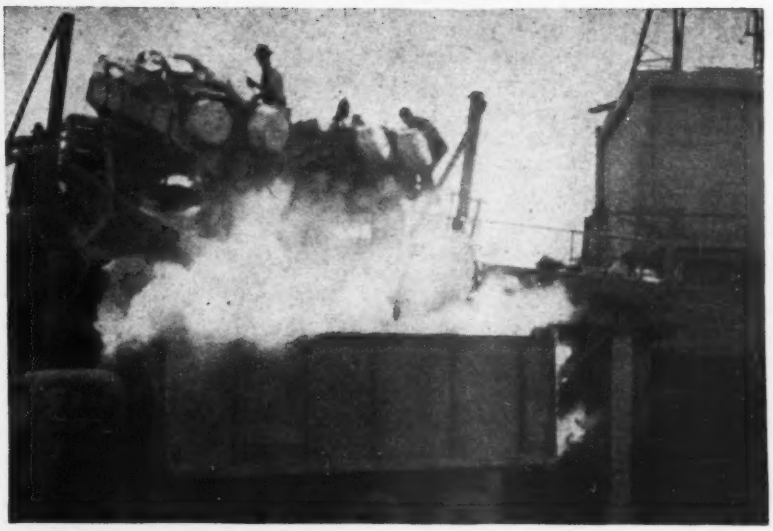


Fig. 2. At the incinerator the trucks first dump ashes, cans and other non-combustibles from the rear compartment, after which they move to the charging floor for discharging the remainder of the load.

Successful basket-grate operation

Long experience with the basket-grates, which have reciprocating vertical movement, has indicated that the design for thermal circulation effectively prevents scaling in the pipes. After the first 8 years of operation the 2-in. pipes for which standard 2-in. water pipe had been used, were replaced with heavy pipe of the same diameter. Otherwise, the pipes from 2- to 6-in. size are the ones originally installed which are still in operation.

Each half of the grate is made up of a separate pipe system in which water circulates to and from a "boiler" or tank atop each half in which a steam pressure of about 25 lb. is ordinarily maintained. The basket-grate operates in a chamber inclosed within a 3-in. water jacket. Steam generated in the movable grates and jacket is used for cleaning and heating around the plant.

Control of grate movement is brought to a pair of pushbuttons at the control station on the stoking floor. The grates are operated intermittently as the condition of the fire justifies. When the operator pushes the starting button the two halves of the grate move up and down alternately until the motors are stopped. This movement causes thoroughly dried material to fall out from between the vertical pipes of the grate halves and also discharges, alternately and from opposite halves of the grate, the thoroughly preheated material from the bottom of the grate where it has had maximum exposure to heat from the fire below.

The draft for the combustion chamber comes from two sources (1) The equivalent of about 1 in. of water pressure from a stack 203 ft. high; and (2) a forced draft of about 3-in. water pressure built up by a blower feeding into the grate chamber on the side away from the stack. This combined draft forces hot gases from the grate chamber into a combustion chamber between grate chamber and stack. In the combustion chamber temperatures range from about 1,250 to 1,800 deg. F.

Highly effective combustion

One of the most notable features of this plant is the effectiveness with which it completely burns up material with a high moisture content. No fuel such as gas, oil or coal is ever used even for starting. When the fires are being started, use is made of dry material such as paper, cardboard and wooden boxes that have been set aside as they came in. When the fire has been well started in this way, the grates are fed with garbage of average quality and an experienced operator can then so coordinate the feeding mechanism that there is no difficulty in reducing to ashes and clinker even material classed as "sloppy wet."

An example of this is in the fact that recently a consignment of 1,800 pounds of government-condemned canned food, tins and all, was put through the incinerator with the regular run of garbage and without any special fuel requirement. These cans, containing string beans, were put through the stoking bin and the basket-grate with other waste material. Sufficient steam pressure was generated in each can to burst it after which the contents were converted to steam or destroyed by combustion. The metal containers, thus opened and emptied, went out with the ashes to the dump.

This dump is about 8 miles from the plant and in a location where there is so little danger of nuisance that cover is considered unnecessary. To it is hauled the ashes from the incinerator as well as the collections of non-combustible material such as tin cans, bottles, etc., for which a separate container is maintained by all Spokane householders. Householders are required to place food waste and all combustible material in a separate garbage can. The garbage trucks use a vertical partition in the dump body to separate these two classes of material. The non-combustibles are loaded in the rear compartment so that this can be dumped first; garbage on the

forward side of the compartment can then be delivered separately. With this arrangement when the trucks arrive at the incinerator the material to the rear of the partition is discharged first. This delivery is made either to a waiting truck which, when full, drives out to the dump or, if no truck is waiting, the delivery is made into an elevated bin which also receives the discharge from a bucket conveyor lifting ashes from the incinerator. All the truck deliveries at the incinerator are by gravity. There is no rehandling of the material except by mechanical means.

Private deliveries permitted

In addition to the garbage brought in by the city dump trucks, individuals or firms are allowed to dispose of waste material at the incinerator. Payment for such disposal is collected on a tonnage basis which varies with the water content of the material delivered. The charge ranges from $3 per ton where the material is "sloppy wet" to 58 cents per ton for dry, combustible material. The minimum charge for weighing and receiving a load is 25 cents.

Private deliveries consist largely of combustibles from nearby industrial plants. The private delivery to the incinerator totals only about 10 percent of the daily deliveries from city collection. These city collections have ranged from a daily average, on an annual basis, of about 45 tons to a maximum of 82 tons per day. This latter figure represents peak capacity for the incinerator if all garbage is to be burned the same day it is collected, as is the rule.

New plant design

The new plant will require the construction of two high-temperature furnaces, a new stack and a new charging device. The two new furnaces will have the same type of water-grate and basket-type stoking mechanism as the existing incinerator. This old unit will continue in operation with but minor repairs.

The existing stack will be torn down and replaced with one some 20 percent larger in diameter and the same height. When the old plant was built about 15 years ago it was necessary to make use of the existing stack which is a concrete structure lined with common brick. Despite repeated attempts at repair this stack now has numerous cracks that have appeared in the concrete. This old stack could probably be repaired and a new lining put in if it were large enough. The new stack is expected to develop a draft equal to 1¼ in. of water pressure and to permit of more efficient combustion because a temperature range of 1,500 to 2,100 deg. F., in the combustion chamber will be possible with the aid of heat stored in the refractory lining.

The movable wall storage bins, although used successfully for several years, will be supplanted in the new design by a traveling crane and clamshell bucket charging device. It is also planned to purchase new collection trucks of the bucket-loading type with longitudinal partitions instead of transverse ones.

Spokane's crematory department is under the general supervision of Ralph Hendricks, Commissioner of Public Affairs. Harlan Coe, superintendent of the crematory, made the original designs and has personally directed its operation since it began operation. To him are to be credited the long continued successful operation as well as numerous mechanical improvements that have evolved with operating experience. William Trezona is assistant crematory superintendent.

Guide for Development of Kansas City Provided by New Master Plan

The master plan for Kansas City, Mo., the guide for the city's development through the next twenty-five to thirty-five years, has gone to the City Plan Commission.

It has been under study by John M. Picton and his staff of city plan engineers three years. After consideration by the commission it will go to the council to be used as the basis for bond proposals for postwar civic development.

The master plan, drawn on broad lines, is of the entire city, including the area south of present city limits to be annexed next January 1. There are nine other maps, breaking down the master plan into detailed drawings, each map concerned with a different phase of the city's future growth.

Residential features are dealt with in the No. 1 map. It divides the city into neighborhoods, then consolidates several neighborhoods of like development and trends into a "community." The neighborhood usually is the section served by one elementary school and the community usually is made up of several neighborhoods served by one high school. The studies show any need for redevelopment or rehabilitation. They show what the tendencies have been and offer suggestions for betterment.

The No. 2 map deals with business and industrial areas outside the downtown district and will form the basis for revision of the zoning ordinance.

Another map shows the existing and planned street and trafficway layout.

One is concerned with public transportation, the street car and bus lines.

The No. 5 map picks up public school problems of the future. It shows present enrollment and population trends. It shows some schools are far from the present center of the population they serve. It will serve as a guide in location of new school buildings to replace schools that are growing old.

Another shows the city's recreation plan of the future, with play and park areas averaging one acre to the 1,000 population.

One separate map deals with community services such as location of libraries, fire stations and police stations, and another with land uses and population densities. The latter map and the studies that have been made will serve as a superzoning document.

The final map of the series covers the downtown district, the street plan, public transit operations, parking facilities and shuttle service between parking lots.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Design of Welded Connections

MANUAL OF DESIGN FOR ARC WELDED STEEL STRUCTURES—by Lamotte Grover. 281 pp. Air Reduction Sales Co., 60 East 42 St., New York 17, N. Y. $2.

Comparable with the manner in which steel handbooks supply information on riveted connections, data have been compiled to form a manual on the design of welded steel joints. With diagrams and tables included to simplify computations, the book is divided into three parts. Part I covers fundamentals of design, typical details, data and diagrams for design calculations, estimation of costs, and inspection; Part II, standardized welded connections for simple framing, tables of allowable loads on beams and piece marks for welded connections; and Part III, data for reference purposes, such as definitions, symbols, acceptable weld profiles and electrodes.

Design Data for Airports

AIRPORTS: DESIGN, CONSTRUCTION AND MANAGEMENT—By Horace K. Glidden, Hervey F. Law and John E. Cowles. 700 p. McGraw-Hill Book Co., New York 18, and London. $7.00.

Airport design is treated in a novel manner in this book. Less than half of the text is a concise discussion of such matters as site selection, topographic and soil surveys, grading, drainage, pavements, lighting, buildings, and traffic control. The remainder of the book is made up of 31 appendixes, which are largely reproductions of publications of the Civil Aeronautics Administration relating to the preceding text matter.

All illustrations are grouped in the back of the book, which may have simplified the publisher's problem but is a very inconvenient arrangement from the user's viewpoint.

As most of the appendixes are CAA detailed specifications for the design and construction of various types of airport paving, the book is the most comprehensive text yet published on that major aspect of airport design.

Because of its concentration on pavement design, the book should form a desirable companion for "Airport Planning" (*ENR*, July 11, 1946, vol. p. 60), which is centered on the functional aspects of airports and also gives considerable space to questions of layout, administration buildings and hangars.

Soils in Engineering

THE ORIGIN, DISTRIBUTION AND AIRPHOTO IDENTIFICATION OF UNITED STATES SOILS—By D. S. Jenkins, D. J. Belcher, L. E. Gregg, and K. B. Woods. 202 p. Technical Development Report No. 52, Civil Aeronautics Administration. Obtainable from the Superintendent of Documents, Washington 25, D. C. $2.00.

Recent years have seen a growing consciousness on the part of engineers of the importance of soils as engineering materials. This has been especially true in highway work where experience has shown that the life of a pavement depends in large measure upon the stability of the subgrade over which it is laid.

And what applies to highways, applies with equal force to airfield construction, which accounts for the great interest that the Civil Aeronautics Administration has taken in soils as an engineering material.

This report is centered on the recognition of major soil types through knowledge of characteristic geologic formations, with special reference to the use of aerial photography in making such determinations. It is based on studies made by the staff of Purdue University for the Civil Aeronautics Administration.

The character and depth of surface soils have a major influence on the conformation of the land, hence a skilled geologist, by noting the form of the land, can make a close guess as to the character of the soil without actually setting foot on it or turning up a spadeful. It is this type of knowledge that this report endeavors to pass on to highway engineers and to airport designers as an aid to them in locating highways or runways to avoid a poor foundation material, or as a means for obtaining good soils nearby if they find it necessary to locate their structures on poor soils.

The appendix is a collection of air photographs of a wide variety of land formations with explanations of the types of soil that are revealed by the land formation shown.

Legal Adventures

THE CONTRACTOR'S LEGAL PROBLEMS—By Norris L. Hayward. 175 pp. McGraw Hill Book Co., New York 18, and London. $2.50.

Compiled and expanded from the popular feature "Legal Adventures of Tractor Conn" appearing currently in *Construction Methods*, this book contains many interesting legal decisions written as if the principal involved was a contractor by the name of Tractor Conn.

The book is written in anecdote style with one legal point made in two or three paragraphs in which the construction man's language, rather than the lawyer's, is used. It is easy reading, with a simple legal point made that can be remembered in each of the 120 short items reported.

Although the book is written for construction men, references to decisions are included so that a lawyer can quickly find the legal reports covering each case.

Women in Engineeering

WOMEN CAN BE ENGINEERS—By Alice C. Goff, 227 p. Privately published by the author, 153 Lauderdale Ave., Youngstown 4, Ohio. $2.50.

To demonstrate that engineering is not a closed field of activity for women, the author, who is a structural engineer specializing in reinforced concrete building design, gives short biographical sketches of twelve other women who have made marks for themselves in the engineering field, including Olive W. Dennis, engineer of service, Baltimore & Ohio R.R., who was the first woman to be elected to membership in the American Railway Engineering Association, and Elsie Eaves, manager, Business News Department, *Engineering News-Record*, the first woman to be elected to corporate membership in the American Society of Civil Engineers. Also included in the book are biographical records of six

women active in professions closely related to engineering.

In her foreword, Miss Goff notes that Russia and Turkey are about the only countries in which no prejudice exists against women in the professions. After establishment of the Soviet Union, women flocked into the scientific and engineering professions, and likewise, in Turkey, after the revolution, women went into engineering work and have found none of the prejudice that is evident here and in Great Britain.

Material Handling

MATERIAL HANDLING EQUIPMENT—by Matthew W. Potts. 172 pp. Pitman Publishing Corp., New York and London. $2.50.

By intention, the book is limited to defining, describing and presenting factory and storage types of material handling machines for permanent installations. It cannot be highly recommended as a book for construction men as the subject is covered in a very general way and machines of construction are entirely omitted. Even so, dependable data on fundamental machines and applications give the book value for those new to the material handling field.

Engineering Charts and Tables

PRACTICAL DESIGN HANDBOOK FOR ENGINEERS—By Alois Cibulka. 475 pp. Clarke & Courts, Houston, Texas. $6.

Chockful of engineering data in chart and table form, this paper-covered book runs the gamut from structural design to thermodynamics, not even omitting noise decibel computation or gear design. Text is kept to a minimum, is hand-lettered and is used mainly as a background for the tabulations. Consisting of ten parts, the handbook covers concrete, steel and timber structures; steel and aluminum shapes; rigid frames and other statically indeterminate constructions; pressure and vacuum vessels; refinery piping; shafts, gears, belts and metals; hydraulics, pumps, heat transfer, insulation, steam, ammonia, and noise measurement; oils, hydrocarbon and chemicals; aerial cable tramways, drilling rigs and guylines; number and conversion tables, differentiation and integration, elliptic integrals, geometric and trigonometric formulas, railroad curves, and electrical data.

Miscellaneous Notes on Booklets and Reprints

THE DIFFERENCE between civil engineering in this country and in Great Britain is strikingly apparent in a pamphlet entitled "Civil Engineering—A Career" by V. J. Wilmoth, managing director of Lomax, Erskine & Co., publishers of *Civil Engineering and Public Works Review*, London. It begins to be apparent in Mr. Wilmoth's account of the schooling of engineers, but is most evident in the survival of the indenturing of boys for practical training in the office of a consulting engineer, for which the parents may be required to pay the consultant amounts ranging from $100 to $1,500 for a three-year agreement. However, this practice of paying the employer rather than the boy is now frowned upon by the Institution of Civil Engineers and the Institution of Municipal and County Engineers.

COMPREHENSIVE STUDIES of highway uses and costs as the basis for a scientific apportionment of costs among various types of highway users is recommended in a report of the Transportation Subcommittee of the Senate Special Committee to Study Problems of American Small Business. The report is entitled "Transportation Program for Small Business," Senate Subcommittee Print No. 14, 79th Congress, 2nd Session. The same committee recommends that the Public Roads Administration be authorized to cooperate with the state highway departments in establishing uniform minimum standards of size, weight and safety of operation for all vehicles that are to be operated over a designated national system of interstate highways.

BOOKS FOR EUROPE

To aid the war-damaged libraries of Europe in restoring their usefulness, an agency known as the American Book Center for War Devastated Libraries has been set up in Washington to collect and forward books and periodicals to those libraries.

In the engineering and scientific field, the Book Center needs copies of text books, monographs, technical reports and periodicals, either bound or unbound. Copies of certain local and federal reports also are wanted, but these should not be shipped without first inquiring as to what is needed.

The Book Center does not have funds to purchase such books and periodicals, and it hopes that donors will assume the cost of transportation, but the center will pay these costs if the donor desires.

Periodicals should be tied together by volumes, with missing issues indicated in the case of incomplete volumes.

Shipments should be sent prepaid by the cheapest means of transportation to the American Book Center, care of the Library of Congress, Washington 25, D. C.

New Engineering Books

AIRPORTS: DESIGN, CONSTRUCTION, AND MANAGEMENT—By H. K. Glidden, H. F. Law and J. E. Cowles. 583 pp. McGraw-Hill Book Co., New York 18, N. Y. $7.00.

MATHEMATICS OF FINANCE—By F. S. Harper. 327 pp. International Textbook Co., Scranton, Pa. $3.25.

ENGINEERING TRIGONOMETRY—By E. M. J. Pease and G. P. Wadsworth. 479 pp. International Textbook Co., Scranton, Pa. $2.75.

MATHEMATICAL AIDS FOR ENGINEERS—By R. W. Dull. 346 pp. McGraw-Hill Book Co., New York 18, N. Y. $4.50.

FLUORESCENT LIGHTING—By A. D. S. Atkinson. 144 pp. Chemical Publishing Co., Brooklyn 2, N. Y. $3.50.

THERMODYNAMICS—By G. A. Hawkins. 436 pp. John Wiley & Sons, New York 16, N. Y. $4.50.

AMERICAN PLANNING AND CIVIC ANNUAL—226 pp. American Planning and Civic Association, 901 Union Trust Bldg., Washington, D. C. $3.00.

THE ORIGIN, DISTRIBUTION, AND AIRPHOTO IDENTIFICATION OF UNITED STATES SOILS—By D. S. Jenkins, D. J. Belcher, E. L. Gregg and K. B. Woods. Technical Development Report No. 52. In two parts. Civil Aeronautics Administration, Washington, D. C. $2.00 from the Superintendent of Documents, Washington 25.

Reports and Pamphlets

AN ANALYSIS OF TAXATION FOR HIGHWAY PURPOSES IN CALIFORNIA—1895-1946—By R. M. Settel. Joint Fact-Finding Committee on Highways, Streets and Bridges, Sacramento, Calif.

PLANNING RECOMMENDATIONS FOR THE WASHINGTON SQUARE AREA—By Arthur C. Holden. Washington Square Association, 65 Fifth Avenue, New York 3, N. Y. $1.50.

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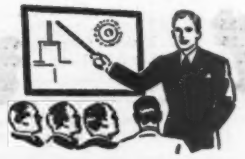

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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

In November, **ASPHALT** prices rose in Chicago, Pittsburgh, and Cincinnati. Paving asphalt delivered in tank cars rose $2.40 per ton in Cincinnati, and $1 per ton in Pittsburgh for deliveries in drums. Cutback asphalt rose $3.40 per ton in Cincinnati and $1 per ton in Pittsburgh. Chicago asphalt emulsion prices rose $.0025 per gal. for tank car deliveries and $.005 per gal. for drum deliveries, while Cincinnati asphalt emulsion prices jumped $.015. **CLAY DRAIN TILE** rose $4 per M lin. ft. in Atlanta.

CEMENT rose $.05 per bbl. in Detroit and $.04 per bbl. in Chicago. Chicago also had price rises of $.12 per ton for **GRAVEL**, $.32 per ton for **SAND**, and $.20 per ton for **CRUSHED STONE**. Carpenters **WAGE RATES** increased $.15 in Boston and Los Angeles, structural iron workers, $.10 in Los Angeles, plasterers, $.175 in Baltimore, and bricklayers and plasterers in Philadelphia both rose from $2 to a range of $2.00 to $2.25. The only gain in common labor was a rise of $.10 in Boston.

CEMENT, AGGREGATE, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT (Per bbl. C/L lots incl. 40c per bbl. for bags, cash dis. not deducted)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE BLOCK (8x8x16-in.; truckload del.; per block)		READY MIXED CONCRETE (1:2:4, over 50 c.y. del.)
	Cloth	Paper	Bulk	Gravel 1½ in.	Gravel ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand-grav	Lt.wgt.Agg.	
Atlanta	$2.77	$2.52	$2.43	$1.79	$1.89	$1.65	$1.79	$1.89	$1.59	$1.69	$0.17	....	$9.00
Baltimore	2.70*s*	2.45*s*	2.20*s*	2.05‡	2.05‡	1.55‡	2.00‡	2.00‡	2.00‡	2.00‡	.145	$0.145*w*	8.00
Birmingham	2.70	2.45	....	2.00	2.00	1.50	2.50	2.50	.90	1.15	.1425	....	6.90
Boston	3.70*bgg*	2.85*b*	2.60	1.50‡	1.50‡	1.40‡	1.25	1.35	....	....	.13	.155*w*	7.90*m*
Chicago	3.60	2.75	2.56	2.35‡*d*	2.35‡*d*	2.55‡*d*	2.35‡*d*	2.35‡*d*	1.75‡	1.75‡	.195	.195*x*	....
Cincinnati	2.59	2.34	2.14	1.20	1.20	1.10	1.80	1.80	....	....	.15	.18*w*	7.45
Cleveland	3.28	2.43	2.18	1.75*i*	1.75*i*	1.40/2.05*i*	1.95*i*	1.95*i*	1.30	1.30	.19	.19	8.75
Dallas	2.51	2.26	2.06	1.80	1.80	1.45	1.72	1.82	....	....	.0875*p*	....	8.20
Denver	3.74	2.94	2.69	1.20	1.45	.90	1.65	1.75	....	....	....	.1625*w*	9.00
Detroit	3.28	2.43	2.23	2.65	2.65	2.35	2.25	2.25	2.00‡	2.00‡	.16	.17*w*	7.85
Kansas City	2.80	2.60	....	2.00	....	1.40	2.00	2.00	....	....	.16	.16*wy*	8.50*x*
Los Angeles	3.30*r*	2.70*r*	....	1.44	1.44	1.33	1.44*f*	1.44*f*	1.44*f*	1.44*f*	.10*bb*	.125*bb*	8.72*m*
Minneapolis	4.10*dd*‡*hh*	3.25*dd*‡	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	.183*ff*	....	7.65*j*
Montreal	....	1.95*r*	1.70*r*	1.65‡*s*	1.65‡*s*	1.60*t*	.80*ct*	.90*ct*	....	....	.1924	....	7.00*u*
New Orleans	2.41	2.16	1.92	1.67	1.65	1.21	....	....	.90	1.15	.23	....	9.25
New York	4.16‡*hh*	3.16‡	....	1.74*deu*	1.74*deu*	1.07*eee*	1.80*de*	1.80*de*	....	....	.16*ii*	.18*wcii*	8.87*kq*
Philadelphia	2.75	2.50‡	2.30‡	1.55‡	1.65‡	1.20‡	1.90‡	1.95‡	1.25	1.25	.155	.155*w*	8.55
Pittsburgh	2.80	2.55	2.35	1.85‡	1.85‡	2.15‡	2.35‡	2.35‡	1.80	1.80	.21*z*	.21*z*	9.35
St. Louis	3.12*o*	2.89*o*	....	1.81‡*o*	1.81‡*o*	1.71/1.81‡*o*	1.25/1.95	1.25/1.95	.90*y*	1.15*y*	.155	.20*yo*	8.70
San Francisco	2.82	2.22	1.92	1.36	1.36	1.36	1.46	....	....	....	....	.23*y*	7.55
Seattle	....	2.75*o*	....	2.35*d*‡	2.35*d*‡	2.35*d*‡	2.85‡*od*	2.85‡*od*	....	....	.165	....	8.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* 5 cu. yds. or more. *r* 20c. per bbl. off cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* In outlying New York districts, price is $1.80. *v* 20c. per bbl. discount; 80c. per bbl. for bags. *w* Cinder. *x* Waylite. *y* Haydite *z* Celocrete. *aa* Pumice. *bb* 6 x 8 x 12 in. *cc* Also 8 x 18 in. *dd* Prices quoted are LCL. Carload lots not available. *ee* In outlying New York districts, price is $1.22. *ff* 8 x 8 x 18 in. *gg* $1.00 per bbl. refund for return of bags. *hh* Refund of $.25. per bag returned. *ii* Yard price.

‡ ‡ CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount. 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add $1.05c. per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 20c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.90	$1.85	Ironton, Ohio	$1.80*	$1.75*	Universal, Pa.	$1.85	$1.90
Hannibal, Mo.	1.90	1.85	Northampton, Pa	1.75	1.70	Waco, Tex. (Plus 9c. tax in Tex.)	1.75	1.80
Independence, Kans.	1.90	1.85	Richard City, Tenn	2.05*a*	1.95	Montreal City (Discount 10c. per bbl. 20 days)	1.68	1.67
			Steelton, Minn.	2.00	1.95			

* Destination price base effective Sept. 17, 1945
a For cloth bags, add $1.00.

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80–300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OIL (Per gal.)	ASPHALT EMULSION (Quick-breaking) (Per gal)	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	$14.00	.....	$0.074	.....	$0.0806*h*	.....	$0.0781	$0.0806	.....
Baltimore	150.00‡	52.70	85.00*m*	15.00*r*	21.00*r*	.06*r*	0.09*r*	13.00*r*	23.00*r*	.06*r*	.07*r*	.14*r*
Birmingham	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boston	85.00	59.00	3.75	16.00	25.00	.0675	.12	18.00	31.00	.0675	.0875	.15
Chicago	150.00‡	65.00/68.00*e*‡	2.85/4.00*d*	15.00/16.00	23.50	14.15/15.00*g*	22.65*g*	.0625/.0675*h*	.155/.16*h*	.05/.0575	.0025/.1025‡	.135/.155‡
Cincinnati	125.00	66.90	.....	19.40	.....	.10	.....	22.60	.....	.09	.10	.....
Cleveland	127.50	39.00	3.87	17.00	19.00	.085	.085	.10*h*	.11	.08	.....	.....
Dallas	.....	40.00	.....	15.36	22.70	.0618	.12	17.95	28.00	.06	.0725	.135
Denver	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	75.00*t*	.....	17.60*f*	26.56*f*	.0734	.128	.0718*h*	.119*h*	.067	.0974	.135
Kansas City	.....	45.00	.....	15.00*u*	20.60*u*	16.60*g*	.....	.07*h*	.0675*hu*	.....	.11	.15*u*
Los Angeles	.....	50.00	.....	9.00*b*	23.00*b*	9.50*bg*	24.00*bg*	9.50*bg*	.....	.03*b*	.08*b*	.16*b*
Minneapolis	.....	.....	2.017*d*	.....	.....	.....	.....	.....	.....	.....	.....	.....
Montreal	70.00	.....	.....	16.60*k*	24.25*k*	.1035*k*	.111*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.188*k*
New Orleans	.....	.....	.....	13.00*a*	.....*s*	12.00*g*	.....*s*	5.75	.....*s*	.05	.....	.....
New York	.....	.....	2.70*n*	18.64	28.49*s*	.0735*t*	29 44*g*	.0751*h*	.1256*h*	.0678	.0768	.1278
Philadelphia	150.00	62.00	4.06	16.00	.....	15.00	.....	.0675*h*	.....	.....	14.00*gr*	.....
Pittsburgh	135.00	39.75	3.90	19.00	26.00	.095	.17	22.00	33.00	.075	.085	.14
St. Louis	.....	42.00	.....	14.80	19.80	13.80*g*	18.80*g*	.0587*h*	.1362*h*	.483	.07	.1215
San Francisco	.....	47.75*e*	.....	11.75	21.00	11.75*g*	.....	13.75	.....	.....	.0525	.1125
Seattle	.....	.....	.....	11.75*k*	22.75*k*	9.50	.....	11.75*k*	14.75	10.90*k*	.0525*k*	.0625*k*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2½ x 8½ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3 x 3½ x 8½ in. *k* Tax included. *l* Quoted on request only. *m* Per thousand. *n* 2 in., treatment 6 lb. *r* February 1943 prices, none later available. *s* Drums not available. *t* Very scarce. Truck deliveries in small quantities.

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¼-in. billet *b*	RIVETS ½-in. structural	WIRE NAILS Base	SHEET PILING Base	STEEL RAILS Per Net Ton Standard	STEEL RAILS Per Net Ton Light	STEEL RAILS Per Net Ton Re-rolled	TRACK SUPPLIES Angle Bars	TRACK SUPPLIES Std Spikes *c*	TRACK SUPPLIES Tie Plates *c*	TRACK SUPPLIES Track Bolts
Birmingham	$2.35	$2.35	$4.75	$3.75	....	$43.39	$49.18	Not	$2.85	$3.65	$2.55	$6.50
Chicago	2.35	2.35	4.75	3.75	$2.65	43.39	49.18	avail-	2.85	3.65	2.55	6.50
Pittsburgh	2.35	2.35	4.75	3.75	2.65	43.39	49.18	able	2.85	3.65	2.55	6.50
Buffalo	2.35	2.35	....	....	2.65	.....	.....	.....	....	....	2.55	....
Cleveland	....	2.35	4.75	3.75	....	.....	.....	.....	....	....	....	....
Youngstown	....	2.35	....	....	....	.....	.....	.....	....	3.65	....	....
Detroit	....	2.45‡	....	....	....	.....	.....	.....	....	....	....	....
Gulf ports	2.70*a*	2.70*a*	....	....	2.85*a*	.....	.....	.....	....	....	....	....
Pacific ports	3.00*a*	2.75*a*	....	4.25*a*	3.20*a*	.....	.....	.....	....	3.90	2.70	....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per el.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb base price	REINFORCING BARS, Per 100 lb., ¼ in., base price: 15 tons or over *b* New billet	REINFORCING BARS: Rail steel	REINFORCING BARS: Add Switch	REINFORCING BARS: $/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots: Std. diamond mesh, 3.4 lb.	EXPANDED METAL LATH: Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots: 4x16 in., No. 5 & 10 wires	WELDED FABRIC REINFORCING: 4x12 in., No. 8 & 12 wires	WELDED FABRIC REINFORCING: 6x6 in. No. 6 & 6 wires Per 100 s. f.	SHEET PILING Per 100 lb. base price
Atlanta	$4.05‡	$4.12‡	$4.12‡	$.025	$.10	$23.16	$25.30	$1.93	$1.45	$2.05	$3.35
Baltimore	3.909	3.344	....	....	.10	24.50	26.50	1.81	1.37	1.93	3.25
Birmingham	....	....	....	....	.10	19.00	21.00	1.91	1.44	2.03	....
Boston	4.162‡	4.194‡	2.97*e*	$20 C.L.	.10	18.50	20.50	1.87	1.41	1.98	3.02
Chicago	2.35*a*	2.35*a*	2.35*a*	.03	.05	22.50‡	24.50	1.78	1.35	1.89	2.65
Cincinnati	3.983	2.90*cd*	2.90*cd*	....	.10	....*n*	....*n*	1.78	1.36	1.89	....
Cleveland	3.838	4.00	3.98	.025	.10	20.50	24.50	1.77	1.35	1.88	....
Dallas	5.25	4.17	4.17	....	....	25.50	27.50	2.04	1.52	2.17	....
Denver	4.89	5.02*e*	....	....	....	37.00	41.00	2.08	1.55	2.21	....
Detroit	3.952‡	3.14‡	3.14‡	....	.10	38.00‡	41.00‡	1.79	1.36	1.90	2.95
Kansas City	4.44	2.75*cd*	2.75*cd*	.0	.05	29.50	31.50	1.89	1.43	2.01	3.062
Los Angeles	4.45*f*	3.025	2.875	.03	.05	23.00	27.50	2.04	1.52	2.17	4.45
Minneapolis	4.142‡	2.99	2.99	.0	.10	25.00	27.00	1.91	1.44	2.03	3.06*d*
Montreal	3.95*i*	3.10*i*	3.00*i*	....	....	31.00*hi*	46.00*hi*	2.87	3.54*i*	2.96*im*	....
New Orleans	4.408‡	3.84	4.108	.05	.10	22.00	24.00	1.93	1.45	2.05	3.125
New York	4.008	2.96*c*	2.96*c*	....	.15	17.50	19.50	1.83	1.39	1.95	2.74
Philadelphia	3.937	3.899	....	....	....	20.50‡	22.50‡	1.82	1.38	1.93	2.97
Pittsburgh	2.35*a*	2.35*a*	2.35*a*	.025	.10	23.00	26.50	1.70	1.30	1.81	2.65
St. Louis	3.401	2.96	2.96	.0	.05	28.00	34.00	1.80	1.37	1.92	....
San Francisco	4.40	3.025	2.875	.025	.10	28.00	31.50	2.04	1.52	2.17	3.30
Seattle	3.00*e*	3.00*e*	....	....	....	43.50	44.00	2.04	1.52	2.17	3.20*e*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *m* Per sq. yd. *n* Practically no carloads are available. Retail price delivered is $27.00 for std. diamond mesh and $29.00 for std. ribbed. *o* 30 tons and under.

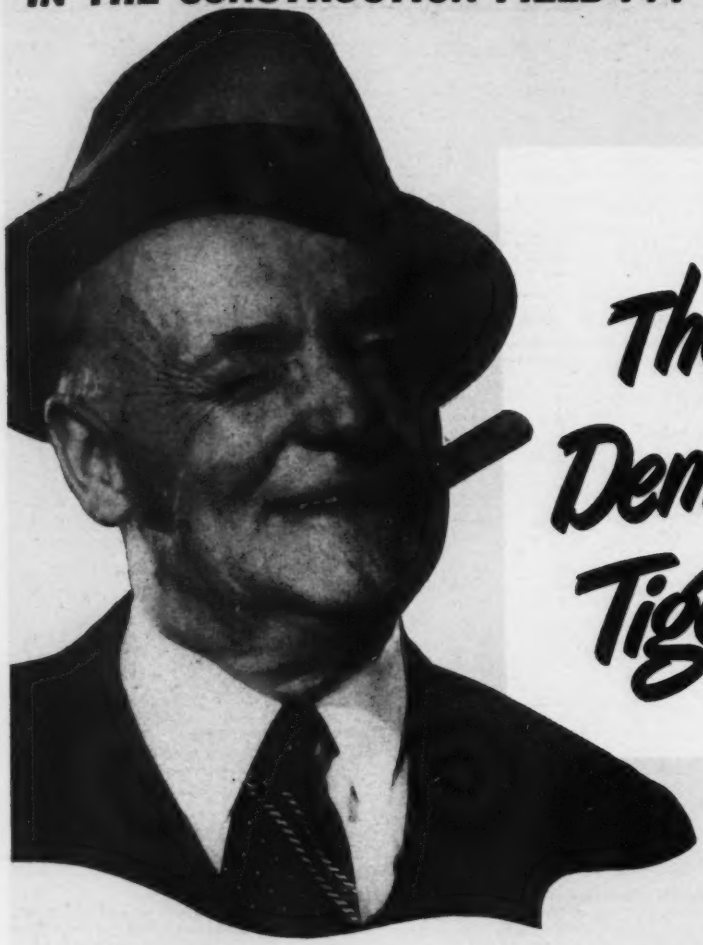
PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, std. 8 in. s.s.	VITRIFIED SEWER PIPE Delivered std. 12 in s.s.	VITRIFIED SEWER PIPE ASTM 24 in.	VITRIFIED SEWER PIPE C13–35 36 in.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	CLAY DRAIN TILE 8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	CONCRETE SEWER PIPE C 14–35 24 in.	WROUGHT STEEL PIPE (Full standard weight, f.o.b. destination *s*) 1 to 3 in., Butt Weld Black %	1 to 3 in., Butt Weld Galv. %	3½ to 6 in., Lap Weld Black %	3½ to 6 in., Lap Weld Galv %
Atlanta	$65.66	$0.43	$0.67	$3.39	....	$114.00	$140.00	$0.45	$2.00	58.5	47.5	56.0	44.5
Baltimore	70.20	.35	.60	2.70	$7.25	160.00	200.00	.85	2.25	62.1	51.1	59.6	48.1
Birmingham	61.00	.35	.63	2.736	....	100.00	220.00	.57	1.80	....	....	....	....
Boston	72.80	.392*m*	.756*m*	3.15*m*	7.995*m*	170.00‡*m*	265.00‡*m*	.53	2.04	....	....	....	....
Chicago	70.33	.49	.945	3.60	....	110.00‡	150.00‡	.45	1.85	64.0*t*	53.0*t*	60.8*t*	49.0*t*
Cincinnati	69.27	.327	.6345	3.735	10.04	98.70	151.60	.38	1.60	62.6	51.6	60.1	48.6
Cleveland	70.75	.226*m*	.513	2.15	5.535	138.50	216.60	.36	1.60	64.71	53.71	62.21	50.71
Dallas	72.43	.365	.657	2.664	6.00	108.00	130.00	.46	1.75	56.5	45.5	53.9	42.4
Denver	77.56	.36	.648	2.70	....	154.00‡	264.25‡	.50	2.00	54.4	43.4	51.6	40.1
Detroit	70.75	.455	8.775	3.375	8.50*l*	170.00‡*m*	263.00‡*m*	.40	1.75	63.1	52.1	60.6	49.1
Kansas City	71.73	.345	.625	2.47	6.85	173.00	312.00	.45	1.60	60.1	49.1	57.2	45.7
Los Angeles	84.40	.36†	.648†	2.988	7.47	130.50	217.50	.25	2.50	....	....	....	....
Minneapolis	73.83	.40†*o*	.825†*o*	2.94†*o*	....	.....	.....	.90	2.40	60.2	49.2	57.3	45.8
Montreal	74.20	.85*k*	1.50*k*	5.25*l*	8.50*ol*	45.00*j*	64.00*j*	.811*j*	2.51*j*	....	....	....	....
New Orleans	67.78	.31	.558	3.558	....	112.00	.....	....	....	58.0	47.0	55.5	44.0
New York	69.60	.52	.96	3.82	9.18	.....	.....	.60	1.40	61.5	50.5	59.0	47.5
Philadelphia	68.10	.40	.7735	3.20	8.50	200.00	275.00	.80	2.15	61.9	50.9	59.4	47.9
Pittsburgh	71.18	.322†*m*	.631†*m*	2.70†*m*	6.625*m*	124.20	193.80	1.05	2.50*g*	....	....	....	....
St. Louis	68.84	.351*n*	.632*n*	2.527*n*	5.60*n*	.....	.....	1.00*h*	2.15*i*	61.9	50.9	58.6	47.1
San Francisco	84.40	.3875*d*	.6975*d*	2.79	6.975	124.50	207.50	.58	2.34	....	....	....	....
Seattle	86.20	.4375*b*	.7875*b*	3.15	....	.....	.....	.56*f*	1.60*f*	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, Burlington, N. J. (base) $66.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Double strength. *d* List. *e* 30 in. *f* Less 5% for cash. *g* Culvert pipe. *h* Reinforced; spec. C–76–37. *i* Reinforced, spec. C–75–37. *j* Centri-spun. *k* Less 50%. *l* Less 53%. *m* Truck delivery. *n* Less 3% for cash. *o* Since carload lots are not available at this time, listed price is based on LCL (no minimum).

s Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ¼ in., 8½c.; ⅜ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within Chicago switching limits.

IN THE CONSTRUCTION FIELD . . .



The BIG Demand is for Tiger Brand!

BECAUSE: It is extra strong and tough.
It offers maximum resistance to
bending fatigue and wear. It is safe and
easy to handle . . . behaves well at all speeds.
It is skillfully made to close tolerances
and unvarying quality standards.
It is backed by a Field Engineering
Service second to none.

AMERICAN STEEL & WIRE COMPANY
Cleveland, Chicago and New York
COLUMBIA STEEL COMPANY
San Francisco
Tennessee Coal, Iron & Railroad Company, Birmingham,
Southern Distributors
United States Steel Export Company, New York

UNITED STATES STEEL

Excellay Preformed

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) *All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)*									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	1x6 s4s	1x8 s4s	2x4 s4s	2x6 s4s	2x8 s4s	2x10 s4s	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	¼"	¾"
Atlanta	$48.25	$48.25	$46.75	$46.25	$47.25	$49.75	.....	.....	.....	$71.00	$71.00	$17.72	$21.37
	62.50	*62.50*	*61.00*	*61.00*	*60.00*	*60.00*	*$54.00*	*$53.50*	*$52.50*	.....	.....	.....	.....
Baltimore	72.50	74.00	69.50	69.00	69.00	75.00	85.00	.....	.....	181.00	175.00	18.45	21.995
	79.00	*80.00*	*73.50*	*72.00*	*77.00*	*78.00*	*92.00*	*85.00*	*83.00*	.....	.....	.....	.....
Birmingham	50.00	50.00	49.50	48.50	49.50	52.50	73.00	.....	.....	72.50	75.00	17.245	20.795
	55.00	*55.00*	*54.50*	*53.50*	*54.50*	*57.50*	77.00	*60.00*	*61.00*	.....	.....	.....	.....
Boston	70.00[2]	72.00[2]	66.50[2]	62.50[2]	70.50[2]	74.50[2]	70.25[2]	.....	.....	.....	.....	18.195	21.995
	64.75	*64.75*	*63.75*	*63.25*	*63.75*	*63.75*	*60.50*	*59.50*	*59.50*	*59.50*	.....	.....	.....
Chicago ‡	65.00	66.00	62.00	62.00	62.00	69.00	75.00	.....	.....	97.00	97.00	14.555	17.555
	65.50	*65.50*	*65.50*	*65.50*	*65.50*	*66.50*	*67.50*	*63.00*	*64.00*	.....	.....	.....	.....
Cincinnati	51.00	52.50	46.00	46.00	48.00	56.00	70.50	.....	.....	68.50	68.50	17.245	20.795
Cleveland	58.50	58.50	56.50	55.50	56.25	58.25	65.00	.....	.....	.....	91.75	17.615	21.265
	64.50	*64.50*	*58.50*	*54.50*	*54.50*	*55.75*	*63.75*	*58.75*	*57.75*	.....	.....	.....	.....
Dallas	54.50	54.50	52.75	51.75[f]	52.25	54.00	56.50	59.50	59.50	89.75	86.00	14.555	17.555
Denver	*77.25*	*77.25*	*73.50*	*73.50*	*72.50*	*73.50*	*74.50*	*76.00*	*76.00*	.....	.....	10.285	12.435
Detroit	82.00	82.00	79.00	79.00	79.00	85.00	92.00	.....	.....	91.00	105.00	17.245	20.795
	.....[j]	.....[j]	.....[j]	.....[j]	.....[j]	.....[j]	.....[j]	.....[j]	.....[j]	.....	.....	.....	.....
Kansas City [a]	76.00	76.00	74.00	72.75	73.25	76.00	95.00	.....	.....	95.00	100.00	12.605	15.205
	78.00	*78.00*	*77.50*	*77.50*	*75.50*	*77.00*	*75.00*	*95.00*	*95.00*	.....	.....	.....	.....
Los Angeles [a]	*74.00*	*74.00*	*74.00*	*74.00*	*74.00*	*74.00*	*80.00*	*79.50*	*79.00*	.....	.....	9.81[gh]	11.86[gh]
Minneapolis ‡[b]	84.00[4]	82.50[4]	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.765	16.615
‡	*85.00*	*85.00*	*79.75*	*80.00*	*78.75*	*80.25*	*74.50*	*76.25/84.25*	*76.75/84.75*	.....	.....	.....	.....
Montreal [e]	69.00	70.00	64.00	68.00	70.00	75.00	.....	.....	.....	.20[i]	.20[i]	.....	.....
	97.00	*97.00*	*97.00*	*97.00*	*97.00*	*97.00*	*87.00*	*87.00*	*87.00*	.....	.....	.....	.....
New Orleans	42.00	42.00	39.00	38.50	34.00	42.00	46.00	.....	.....	54.50	69.00	14.355	17.555
	36.00	*36.00*	*34.50*	*34.50*	*33.50*	*33.50*	*33.00*	*29.50*	*29.50*	.....	.....	.....	.....
New York ‡	Range from $95.00 to $110.00						$105 to $120	.....	.....	.....	.....	18.195	21.995
‡	*Range from $91 to $121*									.....	.....	.....	.....
Philadelphia	85.00	85.00	85.00	85.00	85.00	85.00	85.00	.....	.....	140.00	140.00	18.195	21.995
	90.00	*90.50*	*90.00*	*90.00*	*90.00*	*90.00*	*90.00*	*100.00*	*100.00*	.....	.....	.....	.....
Pittsburgh	55.40	57.80	67.35	59.60	65.45	69.10	80.85	.....	.....	126.00	137.00	17.88	21.63
	73.60	*73.70*	*70.70*	*69.90*	*69.80*	*70.35*	*87.35*	*93.85*	*93.85*	.....	.....	.....	.....
St. Louis	71.50	71.50	70.50	69.25	70.00	72.50	82.75	*85.25*	*83.00*	107.00	104.25	14.555	17.555
San Francisco [d]	*66.00*	*66.00*	*63.25*	*63.25*	*61.25*	*61.25*	*56.00*	*55.00*	*55.00*	.....	.....	7.33[g]	8.83[g]
Seattle	*50.00a*	*50.00a*	*52.25a*	*52.25a*	*51.00a*	*51.00a*	*50.75a*	*52.75a*	*57.75a*	.....	.....	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *c* 5M ft. or less. *d* Sales through wholesale distribution yard (F.o.b. purchaser's truck or carrier, San Francisco paid). *e* Plus sales tax. *f* Up to 18 ft. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* FBM, scarce, no stable quotation, no ceiling. *j* Not available in the city at this time.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¼", $95.15: on ¾", $104.85: price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 Single or Double Thickness A quality	B quality	EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*	
Atlanta	74%	75%	$0.18	
Baltimore	78%	79%	.18	
Birmingham	76%	76%	.135	
Boston	77%	78%	.18	
Chicago	725%	725%	.18	
Cincinnati	77–10%	77–10%	.18	
Cleveland	77%	77%	.22	
Dallas	76%	76%	.1925	
Denver	72%	72%	.185	
Detroit	77%	77%	.18	
Kansas City	77–10%	77–10%	.18	
Los Angeles	86%*d*	88%*d*	.1875	
Minneapolis	73%	73%	.185	
Montreal	40–10–2%*ab*	50–2%*ac*	.1975	
New Orleans	70%	75%	.19	
New York	80–18%*e*	81–18%*e*	.25*f*	
Philadelphia	74%	75%	.18	
Pittsburgh	77%	77%	.1525	
St. Louis	77–10%	77–10%	.185	
San Francisco	66%	73%	.185	
Seattle	75%	75%	.1875	

Price of 60% Ammonia Gelatin is $0.01 per lb. higher than 40%

c Discount from list Sept. 1939: sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers' list Sept. 15, 1928. *e* Discount from jobbers list Jan. 16, 1946. *f* In borough of Kings, Queens and Richmond, and in Manhattan south of Canal St., add delivery charge of $6.00 per trip.

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E of the Miss., except Fla. and Me.	$0.135	$0.16	$0.18
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.14 –.1475	.165 –.1775	.185 –.1975
Rocky Mtn. States	.14 –.1525	.165 –.1825	.185 –.2025
Pacific N W. States	.1375–.15	.1675–.18	.1875–.20
Pacific S W. States	.1350–.1425	.165 –.1725	.185 –.1925

PILES, TIES F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine *	Fir
12 in. at butt	6 in.	30 to 50 ft.	$0.34	....
12-in.— 2 ft. from butt	6-in.	50 to 59-ft.	.35	....
12-in.— 2 ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in.— 2 ft. from butt	6-in.	90 to 100-ft.	....	.56
13-in.— 3-ft. from butt	5-in.	91 to 100-ft.	....	.58
14-in.— 2-ft. from butt	6-in.	50 to 69-ft.	.41	.65
14-in.— 2-ft. from butt	6-in.	70 to 79-ft.	.43	.59
14-in.— 2-ft. from butt	5-in.	80 to 85-ft.	.54	....
14-in.— 2-ft. from butt	5-in.	85 to 89-ft.	.57	....
14-in.— 2-ft from butt	5-in.	90 to 100-ft.	....	.64

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.50	.....	$2.00	.....
	Pine	2.00	$3.00*a*	2.50	$3.00*a*
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.86
	Mixed Oak	1.71	2.59	2.42	3.58
Birmingham	Hardwood	1.00	1.60*a*	.....	2.25*a*
Chicago	Red Oak	.....	2.45/2.65*a*	.....	3.35/3.60
Los Angeles	Douglas Fir	2.10	3.35*a*	3.00	4.80*a*
Philadelphia	Red Oak	....	2.10*ag*	.....	3.25*ag*
St. Louis	White Oak	1.80	.....	2.40	.....
	Red Oak	1.73	2.25*a*	2.19	3.25*a*
	Sap Pine or Cypress	1.80	.....	2.06	.....
San Francisco	Douglas Fir	1.25*bd*	....	.....	3.00*caf*
Montreal	Birch or Maple	.....	1.65	1.04	.....

Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 6"x8"x8'6" *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. *g* January 1943 price, none later available.

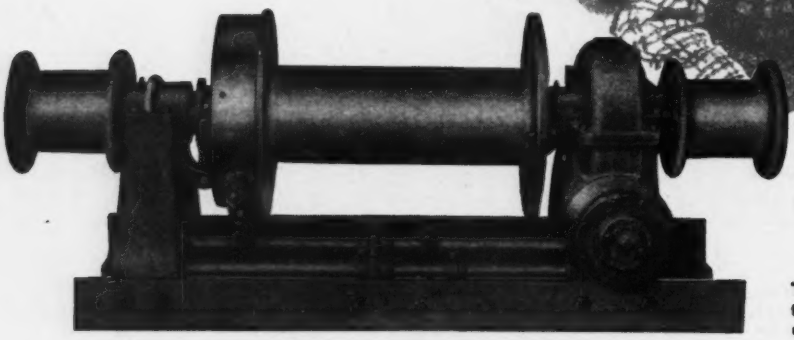
CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100-lb	$2.50– 3.10
Chlorine cylinders, liquid, per lb. delivered	.0525
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton	18.50–35.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags	1.15–1.20
Sulphate of copper, in bbl., per 100-lb	5.00

Oil Field Driver's Report

"A Tulsa Winch is standard equipment in the oil fields... they're built for the tough jobs!"



Tulsa Winches are conservatively rated with ample margin for safety.

Take the Oil Field Drivers Word for it . . .

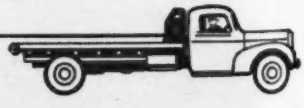
Compare these Features Before You Buy

1. **REMOVABLE GEAR COVER.** On all models, makes practically all working parts accessible, without removing winch from truck.
2. **CLUTCH.** Manganese steel heavy duty positive type.
3. **DRUM SHAFTS.** Alloy steel, heat treated and ground. With end milled key ways and alloy steel keys.
4. **DRUMS.** Well ribbed and designed to prevent crushing. Large drum bearings.
5. **DRUM SHAFT BEARINGS.** Removable bronze. Bronze gear thrust bearing on all models.
6. **WORM GEARS.** Bronze machine cut, mounted on steel or malleable carriers.
7. **WORM BRAKE.** Automatic, adjustable. Sealed off from grease.
8. **WORM SHAFT BEARINGS.** Heavy duty deep groove ball bearings.
9. **WORM.** Forged steel, heat treated, hardened, and ground journals and ground threads.
10. **BASE.** Wide, well designed to prevent pulling off truck.

The Tulsa Winch, is considered by many truck drivers and contractors an essential piece of equipment. Every truck that has heavy work to do should be equipped with a Tulsa Winch. Whatever your needs: for loading and handling materials, there is a Tulsa Winch for all truck sizes, ½ ton to 5 tons and larger. The Tulsa Winch distributor in your area will be glad to tell you more. Literature on request.

Tulsa Winch

TULSA, OKLAHOMA DIVISION OF VICKERS Inc



STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity. Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carload lot, Pulverized, or lump
Atlanta	$112.50	$132.60	$234.60	$244.80	$273.40	$306.00	$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	90.00	95.00	175.00	200.00	260.00	300.00	23.75k	29.75k	20.00	15.00	2.50m
Birmingham	91.00	96.00	133.00e	216.00	.....	.....	18.50	21.00	19.11	15.05	16.05
Boston	105.00†	112.00†	210.10†	252.09†	.....	.....	20.00i	20.00i	21.00†	.....	16.00
Chicago	92.10	98.40	185.20	x	x	x	18.50	19.50	18.00	16.00	.....
Cincinnati	75.39	80.39	150.90	170.91	242.35	277.25	33.00	33.00	16.90	14.40	.....
Cleveland	98.10	104.55	x	196.00	.....	.....	24.00	24.00	17.05	14.55	19.55
Dallas	77.25	83.00	165.00	198.00	254.50	315.00	17.25	19.00	19.00	15.00	15.00
Denver	105.25	119.00	198.25	230.00	253.50	315.25	23.50	28.00	30.00j	28.00j	26.00
Detroit	92.70	96.70	174.50	198.80	257.20	294.30	24.00f	24.00f	22.00	20.00	20.00
Kansas City	.....	.....	.....	.....	.....	.....	17.50	18.50	30.40	24.00	24.00
Los Angeles	82.50†r	97.50†r	135.00c†r	210.00†r	368.00†r	460.00†r	16.50	18.50	16.50	17.50	17.50
Minneapolis	.....	.....	186.25b	.....	.....	.....	18.50p	.....g	26.00bb	21.00bb	22.00bb
Montreal	92.50a	98.50a	196.25a	151.50a	.....	294.40a	22.16†u	29.41†u	12.50u	14.00u	8.00u
New Orleans	104.50	109.55	207.25	222.25	326.90	385.65	17.75	.....	18.30	12.08	14.10
New York	103.90	110.80	152.35	164.20hn	x	x	25.50	.....	22.00	17.00	22.00
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	24.75	27.75	22.00	18.00	17.00
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	23.25	25.25y	19.40cc	16.90cc	2.85m
St. Louis	.....	.....	.....	.....	.....	.....	26.00s	25.00s	21.00s	20.00s	...68s
San Francisco	102.40	115.20	153.60	115.20r	.....	.....	23.00	.....	19.90	19.90	1.99m
Seattle	129.25	141.50	x	141.50cc	.....	.....	23.00k	23.00k	20.00s	20.00s	3.00m

* F.o.b. a Smooth. b Carload lots delivered to job. c 6 x 12 x 12 in count 10 days. e 2% discount for cash. f 5½ x 8 x 11½. u 8% sales tax included. v sand lime. x Not available. y Stacked. z Pebble lime, price per 80 lb. sack. bb LCL, delivered. cc Truck delivery.
f Includes $3.50 per M. for delivery. g No quotation. h F.o.b Perth Amboy, N. J. i F.o.b. Warehouse only. j OPA Price. k $1.00 discount. m Per bbl., 180 lb. n 7½ x 7½ x 12. Speed tile. o Per bbl., 200 lb. r 5% dis-

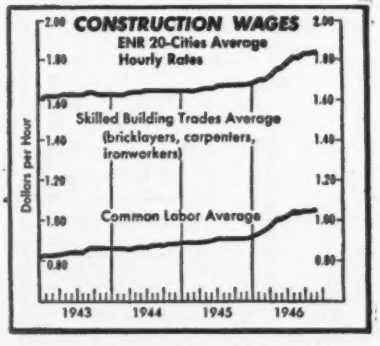
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in. 600-lb. (Approx.) Dry a	WHITE LEAD bbl. Per 100 lb. in oil w	READY-MIXED PAINT Graphite b	Per gal., drums Aluminum c	Ferric Oxide d	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$12.00	$15.625	$1.75	$2.70	$1.65	$2.06	$2.06	$2.06	$1.00	$36.00
Baltimore	11.75	15.25	2.00	3.00	2.50	2.35	2.90	2.90	.40	29.00
Birmingham	12.00	15.625	2.35	3.70	2.08	2.28	2.20	2.20	.32	28.70
Boston	11.75	15.25	1.75	2.50	2.31	2.00‡h	3.30‡ut	3.30‡ut	.25‡	21.00‡
Chicago	11.75	15.25	....	....	....	1.75hf	1.99hf	1.99hf	.33f	23.00f
Cincinnati	11.75	15.25	1.70	2.90	1.60	2.20	2.10h	2.10h	.33	25.00
Cleveland	11.75	15.25	....	....	....	1.71	1.63h	1.61h	.237	25.00
Dallas	11.75	16.00	1.88	2.95	.06l	1.89h	2.00h	2.00h	.65	37.00
Denver	11.75	15.75	1.76	3.45	2.36	2.53	2.36h	2.36h	.29	29.00
Detroit	11.75	15.25	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	11.75	15.375	2.30g	2.55g	2.16g	2.50	2.75	2.75	.52	.....
Los Angeles	12.00	15.75	2.00	2.60	2.50	2.10	1.50	....	.45	.....
Minneapolis	11.75	15.375	....	....	....	1.90i	1.85hi	1.85hi	.32	23.00
Montreal	.....	.....	2.50p	4.90p	3.15p	2.85	2.45t	2.45t	.84	1.83k
New York	11.75	15.25	2.03	....	1.82	1.9006	1.8468o	1.8468o	.26	23.00
Philadelphia	11.75	15.25	1.60/1.80	2.20	1.55	2.30	2.81	2.81	.32	23.00
Pittsburgh	11.75	15.25	1.95	2.40	1.75	2.15	2.09h	2.09h	.34	27.00
St. Louis	11.75	15.25	2.28s	2.89s	1.96s	2.01h	2.01h	2.01h	.46	28.00
San Francisco	12.00	15.50	1.80	2.75n	1.35	1.7613	4.72	2.472	.3399	21.115
Seattle	12.00	15.75	1.90	3.00	....	2.15	2.16h	....	.35	31.00j

‡ Delivered. Note: Red lead in oil 50c higher than white lead in oil. a Red lead prices change frequently due to pig lead price changes. b U. S. War Dept. Spec. 3-49A. c ASTM Spec. D266-31. d 80% minimum ferric oxide. f Distributors' price to contractors. g 55 gal. can. h Per roll, 65 lb. i Minneapolis and vicinity. j Asphalt pitch. k per cwt. n May, 1941 price. o 60-lb. roll. p Plus 8% sales tax. s December, 1942 price. t Federal tax included. u 90-lb. roll. v Truck delivery. w Price to large paint contractors is $1 less.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$2.00	$1.50	$1.625	$1.50	$1.62	$0.75	$0.80
Baltimore	1.90	1.775	1.90	1.625/2.00	1.90	.95	.95
Birmingham	1.9375	1.50	1.625	1.50	1.65	.65	.65
Boston	1.725	1.75	1.85	1.65	1.667	1.25	1.25
Chicago	2.00	1.95	1.95	1.95	2.00	1.30	1.30
Cincinnati	1.875	1.65	1.775	1.875/2.125	1.875	.95	.95
Cleveland	2.00	1.90	2.00	2.00	2.00	1.25	1.25
Dallas	1.9375	1.425	1.625	1.625	1.75	.80	.80/1.25
Denver	1.98b	1.70	1.70b	1.70b	1.90	1.10	1.10
Detroit	2.00	1.825	2.00	1.85/2.00	2.00	1.275	1.275
Kansas City	2.00	1.75	1.875	1.875	2.00	1.175	.90
Los Angeles	2.00	1.75	2.00	1.65	2.05	1.25	1.25
Minneapolis	1.825	1.65	1.75	1.70	1.85	1.15	1.15
New Orleans	1.625	1.375	1.625	1.55	1.625	.70	.80
New York	2.25b	2.10b	2.25	2.25b	2.25b	1.25	1.20
Philadelphia	2.00/2.25	1.775	1.90/2.00	2.25	2.00/2.25	1.025	1.025
Pittsburgh	2.15	2.00	2.00	2.05	2.00	1.15	1.15
St. Louis	2.00	1.95	2.00	2.20	1.90	1.00	1.00
San Francisco	2.05	1.75	2.00	1.85	2.00	1.25	.125
Seattle	1.975	1.675	1.80	1.90	1.975	1.275	1.30
Montreal*	1.17	1.06	1.11	1.07	1.17	.62	.65



b 7 hr. day. * Cost of living bonus now included in basic wage.
ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.855
ENR Common Average: $1.078

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

Aluminum Building Wire—Because of the current copper shortage *United States Rubber Company* has announced that it will substitute aluminum for copper in some of its building wire and cable. The insulated aluminum wire will be made in all sizes, as approved by Underwriters' Laboratories. Aluminum has high electrical conductivity, light weight and adequate flexibility, and aluminum wire has been developed with the same overall diameter as equivalent copper sizes.

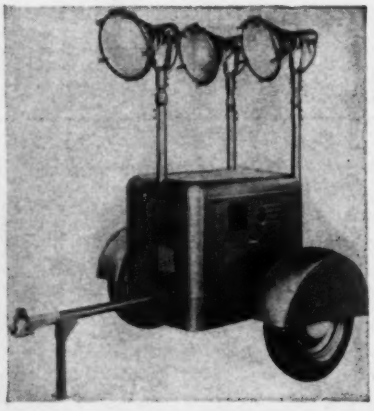
Since aluminum is in plentiful supply, it is expected that the company will be able to ease the wire shortage resulting from the temporary scarcity of copper and thus remove one of the obstacles to building construction.

Tandem Roller — The 2 to 2½-ton Pierce Bear roller, soon available, is driven from within the compression roll, it is claimed, in such a manner as to roll 100 percent against a curb up to 24½ in. high, within 1½ in. of a high wall or building. Two paired rolls in front are made of fabricated and welded steel plates, with spacing washers between to permit easy steering; each half may be ballasted with water. The single rear roll has watertight heads and pintle made of fabricated and welded steel plates.

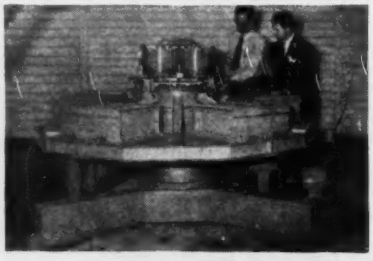
The body, of special design, eliminates many parts normally used, and steering is of the conventional worm and segment type.—*Lewis Manufacturing Co.*, 415 *Hoefgen Ave., San Antonio 6, Tex.*

Engine De-Scaler—Developed to keep radiators and motors of trucks, tractors, and industrial engines permanently free of scale, Butler AT 1 self-energizing electronolytic de-scaler is said to prevent pitting and corrosion. It prevents formation of scale and brings about gradual, efficient cleaning of the entire cooling system.

This non-chemical device, harmless to rubber and metals, is fully automatic, without wires or switch connections. It is easy to install and designed to operate efficiently for a period of one year, or a minimum of 25,000 miles.—*Butler Engineering Co., P. O. Box 1699, New Orleans 11, La.*

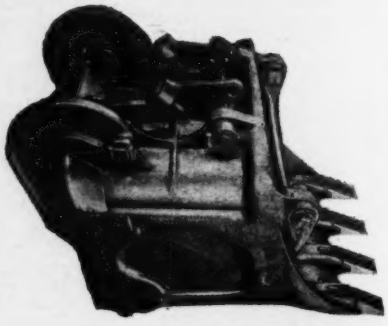


Portable Power Unit — Gas engine driven generator can be used for illumination on night shift, as well as for operation of electric saws, drills, etc. It is equipped with an air cooled engine that won't overheat in summer or freeze in winter; it stops and starts by means of push buttons on control panel. Two 6-v. starting batteries are charged automatically by a separate D-C generator while the unit is in operation.—*Revere Electric Mfg. Co., 6009 Broadway, Chicago 40, Ill.*



Concrete Block Maker — *A. R. Plambeck*, chief tool designer, and *Joel T. Henry*, president, of *Henry & Hutchinson, Inc.*, designers and builders of *Decatur, Ga.*, prepare for a test run on the new high production concrete block machine designed and manufactured by the company. The machine is capable of delivering up to 20 standard size blocks per minute and employs a rotating table with all operations being performed simultaneously at four adjacent stations. Two types of models are under construction, one pneumatic and the other hydraulic.

Electrode Selection Chart — A graphic, four-color, 25 x 40-in. electrode selection chart has been published to assist operators in the choice of the correct electrode for a particular job. The chart specifies which electrodes to use, shows currents, gives mechanical properties, and also includes an electrode color guide which shows the electrodes in their actual colors.—*Air Reduction Sales Co., 60 East 42nd Street, New York, N. Y.*

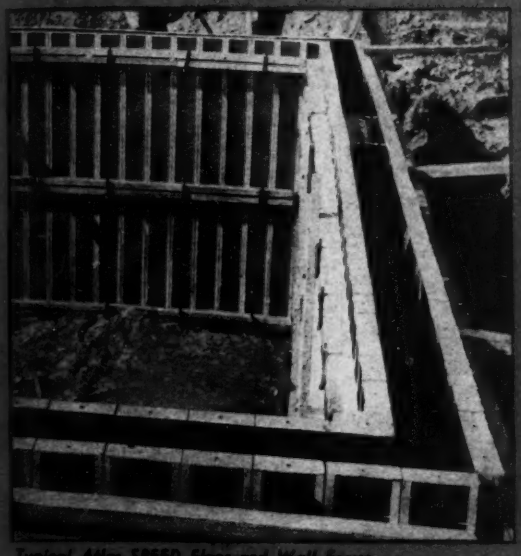


Welded Shovel Dippers — Austenitic manganese steel in a dipper designed for durability and minimum weight provides maximum resistance to fracture and wear. Over-lapping, rabbeted joints leave grooves for a welded bead. The parts are fitted together with round plugs, around which weld metal is deposited. A worn front may be removed and a new one welded in place without destroying the back.

Dippers of ¾ to 2-cu.yd. capacity are made in two body pieces, front and back; sizes over 2 cu.yd. are made in four pieces; front, back and two side plates.—*American Manganese Steel Division, American Brake Shoe Co., Chicago Heights, Ill.*

Blast Cleaner—The Vacu-Blaster, a new blast-cleaning device has a vacuum return system which permits no abra-

ATLAS LABOR-SAVING SPEED FORMS



Typical Atlas SPEED Floor and Wall Forms
You CAN speed up concrete construction and cut form work costs 25 to 50% with Atlas Steel Forms.
Easier to set up, strip and move than plywood forms. Cost less than Plywood. Light-weight; average only 35 lbs. per unit. Inserts easily and accurately accommodated.

Patent Pending
Strong—no studs or joists required as with wood forms. Durable—can be used over and over indefinitely. Finish is smooth and free from grain marks, knots or honeycombs—only a few lines. Type A forms leave slight fins. Type B no fins. *Ask for folder.*

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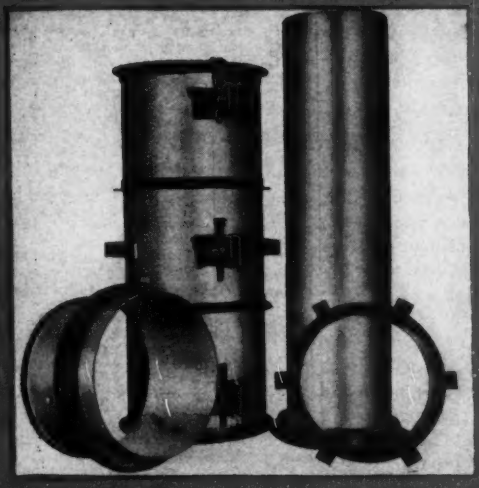

ATLAS CONCRETE PIPE FORMS—You SAVE Time and Money with ATLAS CONCRETE PIPE FORMS because you can count on them to stand up under hard usage, hold their shape and turn out high grade pipe over a long period of time . . . pipe which is smooth, round and true with joints that fit accurately together.
Operation is speedy both in setting up, filling and removal of pipe. Write for complete facts.

BRIDGE PIER FORMS on Route 40, Somerset, Pa., Cayuga Const. Co., General Contractors. Piers are 120' high, 11' diameter at base, 5' diameter at top. Arch is supported by centering. Cross wall is 60' high. Steel forms gave true contour and smooth surface—no finishing necesary. A pour of 28'-0" of concrete per lift was required with forms which could be set up, stripped and moved rapidly from pier to pier.

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333 STRUMEL STREET **IRVINGTON, N. Y.**

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You can forget about closed streets and the delays, hazards and inconvenience of trenching when you use ARMCO Tunnel Liner to install new sewers. The work moves quickly and economically and business above ground continues as usual.

Fast tunneling is the rule with ARMCO Liner Plates. Even inexperienced crews can install them quickly. One man easily handles the lightweight steel sections, bolting them together with regular wrenches.

And you buy *sinewy strength*—not bulky pounds. This means less excavation; also storage requirements are smaller. You gain added safety, fire protection, and experience shows that ARMCO Plates cost less to carry a given load than any other type of tunnel lining.

Consider tunneling that next sewer job with the aid of ARMCO Liner Plates. Motorists and property owners will thank you and the chances are you'll "hole through" ahead of schedule and under the estimate. Write today for complete facts. Armco Drainage & Metal Products, Inc., and Associated Companies, 1455 Curtis St., Middletown, Ohio.

ARMCO

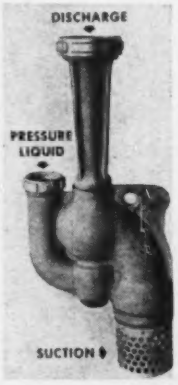
TUNNEL LINER PLATES

sives or other particles to escape into the open. Operated in much the same fashion as a simple household vacuum cleaner, the machine may be used without special precautions or preparations. No masks, goggles, or protective clothing are needed.

Many types of abrasives may be used, depending upon the nature of the work to be done and the finish desired. Spent abrasive is reclaimed by the Vacu-Blaster and re-used as long as it remains effective.—*Vacu-Blast Co., Inc., 1045 Broadway, Burlingame, Calif.*

Shovel and Crane — The TL-20 shovel and crane, embodying many new engineering and design principles, including unit assembly, can be equipped with a choice of five interchangeable booms and ten different types of mountings, enabling it to meet any and all job conditions. An important feature of its turntable design is the unit assembly principle which enables each major component, the clutch shaft, the cab, the engine and accessories, and the hoist shaft, to be removed as a unit and replaced with a similar complete unit. —*The Thew Shovel Co., Lorain, Ohio.*

Jet Pump — Portable eductors find ready use in pumping operations as they are said to combine versatility with low initial and maintenance costs. They are of simple, sturdy construction with no moving parts and can be made of a variety of materials including plastics to fit conditions.



A high velocity pressure jet entrains the secondary liquid to be moved and converts the kinetic energy of the pressure liquid into static head capable of lifting water up to 75 ft. The pressure water used may be obtained from water mains, pumps, head races or similar sources. No foundations are required

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Detroit and Grand Rapids—
Wolverine Tractor & Equipment Co.
MINN...Minneapolis & Duluth—Foshot Equipment Co.
MISS...Jackson—Mississippi Road Supply Co.
MO.....St. Louis—Missouri-Illinois Tractor & Equip. Co.
Kansas City—Noel V. Wood, Inc.
MONT..Billings & Missoula—Industrial Equipment Co.
Great Falls—Hi-Line Equipment Co.
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Plainview & Abilene—Plains Mach. Co.
El Paso—Hardin and Coggins
UTAH...Salt Lake City—The Lang Company
VA.....Richmond—Municipal Sales Company
Richmond and Roanoke—Rish Equipment Co.
Alexandria—Phillips Mach. & Tractor Co.
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W. VA...Charleston and Clarksburg—Rish Equipment Co.
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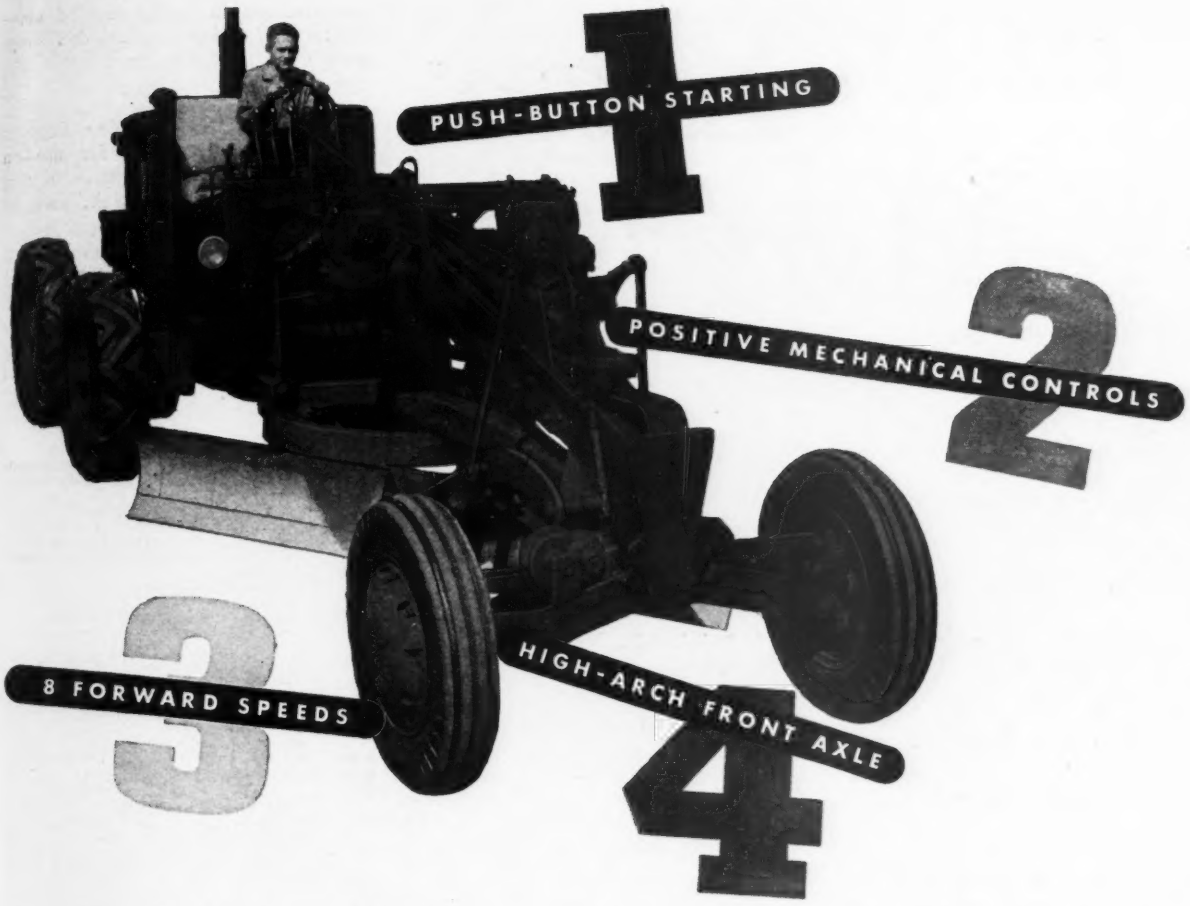

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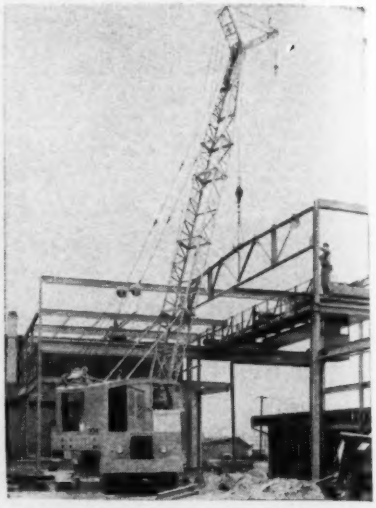
and hose can be easily coupled on.—*Schutte & Koerting Co., 12th & Thompson Sts., Philadelphia, Pa.*

Waterproof Coating for Porous Walls—Especially suited for use on concrete and cinder-block walls, a new waterproof coating, Tite-Wall, may be used on practically any rough, porous surface. When applied in two coats it is said to have remarkable water-resisting qualities. This material may be easily applied with brush or roller. It comes in white and five tints.—*Truscon Laboratories, Inc., Caniff & Grand Trunk R. R., Detroit 12, Mich.*



Truck Crane—Lifting capacity of 304 truck crane is 40,000 lb. with outriggers, 15,800 lb. without outriggers Both are 85 percent ratings. Same base machine used on 304 crawler model is utilized on this unit. Booms are available in lengths up to 110 ft. Jib boom extensions are offered in 15- to 30-ft. sizes. Removable outriggers are optional, permit efficient operation as a shovel, pull shovel or dragline.—*Koehring Co., Milwaukee 10, Wis.*

Resaw Attachment—A resaw attachment for use on Zephyr model 36 has just been announced, which bolts directly onto the column of the bandsaw and when not in use swivels out of the way so the saw can be used for scroll work and other bandsaw applications.—*The DoAll Co., 1301 Washington Ave. S, Minneapolis 4, Minn.*

Stainless Steel Gates—A Rodney Hunt stainless steel gate unit is said to control acid and corrosive stock, for example, sewage. Non-corrosive, not affected by process water and waste, this

partners in creating

So clearly and unmistakably are draftsmen able to express their ideas on paper that their drawings have re-shaped the world. Through line, figure and symbol, draftsmen define the work to be done by the labor and machines of a nation. Assisting them to attain precision and clarity are drafting instruments that act almost as living extensions of their own hands...instruments that function figuratively as their partners in creating.

For 78 years Keuffel & Esser Co. drafting equipment and materials have been partners, in this sense, in shaping America, in making possible its swift-moving highway traffic, its speed in conducting business, its victorious might in war ...So universally is K & E equipment used, it is self-evident that every engineering project of any magnitude has materialized with the help of K & E. Could you wish any surer guidance than this in the selection of your own "drafting partners"?

You will find special advantages, for example, in PHOENIX* Tracing Cloth, which K & E has made almost "ghost-proof." Here is a cloth from which you can erase either pencil or ink lines without risking untidy "ghosts" on the prints, a cloth practically immune to stains from perspiration and water. You can even soak it in water for ten minutes at a time without harm! For further details about PHOENIX* Tracing Cloth, write on your letterhead to Keuffel & Esser Co., Hoboken, N. J.

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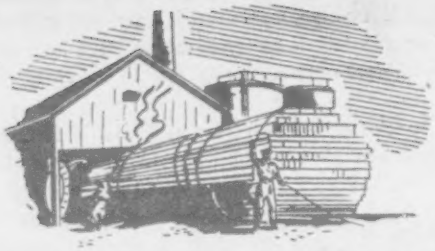
PRESSURE IS PROTECTIVE TREATMENT



For most effective wood preservation, the chemicals must be forced *deep* into the wood. American Lumber & Treating Company obtain this deep penetration by the vacuum-pressure method in closed steel cylinders. Dipping, brushing on, or other makeshift methods can't begin to give comparable results. So, when you buy treated lumber, remember to say, "*pressure*-treated" . . . it's best!

Whatever your needs —

AMERICAN LUMBER GIVES YOU ALL 3

1. Wolmanized Lumber* — protects against decay and termite attack.
2. Minalith—fire-retardant.
3. Creosoted lumber.

*Registered trademark

1649 McCORMICK BUILDING, CHICAGO 4, ILLINOIS

gate will give efficient, trouble-free service. The 48-in. dia. complete unit is an all wedge type gate, for pressure in either direction. Other designs are available.—*Rodney Hunt Machine Co., Water Controlling Apparatus Division, Orange, Mass.*

Trailer-Mounted Derrick — Ideco "Kwik Lift" telescoping mast mounted on Fruehauf carryall trailer is shown on deep-well servicing, exploratory work and slim-hole drilling and is adaptable to construction operations. Unit shown has 89-ft. mast, which permits pulling 60-ft. tubing. Masts up to 130 ft. can be provided.—*Fruehauf Trailer Co., Detroit, Mich.,* and *International Stacey Corp., Columbus, Ohio.*

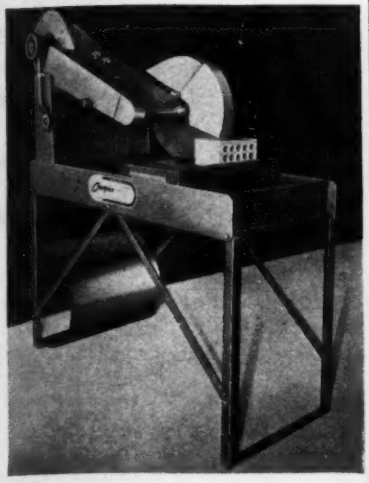
Motor Graders —Distinctive high-arch front axle is featured in three new motor graders, No. 512 (extra-heavy duty), No. 414 (heavy duty), and No. 312 (medium duty). It is claimed that the high arch front axles give greater axle clearance than other graders, providing twice the capacity of conventional axles for straddling large windrows. All three sizes are powered by International diesel engines, available with cab-controlled push-button starting, and have a range of eight forward and two reverse speeds. Special bulldozers and snow plows have been designed as optional equipment.—*J. D. Adams Mfg. Co., Indianapolis 6, Ind.*

High-Pressure Pumps —Type ES pumps are designed for small quantity pressure fluid applications up to 200 psi. Standard vertical ball bearing motors are used. Changes in capacity cause only very slight changes in pressure, thus affording remarkably even head control.—*Economy Pumps, Inc. Hamilton, Ohio.*

Fire Hose —An "All-Weather" Cabledge line of water repellent, mildew resistant fire hose is built to withstand abrasive action of gravel, cinders or rough surfaces over which it may be dragged. It is flexible for easy handling at time of fire, and for racking. —Made exclusively for *American-La-France-Foamite Corp.* by the *Goodyear Tire & Rubber Co.*

Belt Grinder Attachment—A light, narrow belt grinder attachment, type N-2, has been developed capable of performing all kinds of light burring and grinding operations. Combining the versatility of platen grinding with the economy and speed of contact grinding

it is ideal for light grinding of flats, arcs, angles, gear burring, weld grinding, cleaning up operations, etc.—*Porter Cable Machine Co., Syracuse, N. Y.*



Portable Masonry Saw—A new portable dustless masonry saw for accurately cutting tile, brick and concrete on the job is said to bridge the gap between wood cutting and metal cutting. It has a self-contained water supply system and contains many features which contractors demand in practical high speed construction. Blades, chisels, marking pencils, hammers and other pertinent tools are kept in a cabinet under the carriage.—*Champion Mfg. Co., 1307 Washington Ave., St. Louis 3, Mo.*

Industrial Paint—Known as Rustrem (Rust Remedy) a new black paint seals rusty surfaces; stops rust permanently. It can be applied directly over rusty surfaces without cleaning or scraping. Wherever metal must be protected, Rustrem is said to prevent further oxidation and to provide a base for decorative paints.—*Speco, Inc., 3142 Superior Ave., Cleveland, Ohio.*

Portable Apron Feeder—This long feeder, mounted on its own chassis and wheels, with hopper attached, can be swung into place quickly. Now made in 36-in. width and measuring 30 ft. from center to center of head and tail shafts, it is supported on single axle equipped with dual pneumatic tires. Steel wheels are optional.—*Pioneer Engineering Works, Inc., Minneapolis, Minn.*

SELF-LOCKING *Prevents Mould Damage* **FROM FALLING NUTS**

The Red Elastic Collar locks fast against 1050 rpm screening VIBRATION

Vibration-loosened fasteners were once a production problem in the cinder block plant of the Plasticrete Corporation at Hamden, Conn. The violent reciprocating action of the screens shook ordinary fasteners loose and permitted them to drop into the block moulds. Production was interrupted constantly to repair the damaged moulds.

ESNA Elastic Stop Nuts—with the self-locking, self-sealing Red Elastic Collar—were substituted. They held tight against Vibration. They protected the working threads against Moisture Penetration and Corrosion. They speeded maintenance because they were easily removed for worn screen replacement. And they were reusable without loss of self-locking, self-sealing effectiveness.

ESNA Elastic Stop Nuts are the *only* detachable fasteners used on Plasticrete's screens. This standardization achieves the double economy of inventory simplification and reduced procurement costs. For further information address: Elastic Stop Nut Corporation of America, Union, New Jersey. Sales Engineers and Distributors are conveniently located in many principal cities.

LOOK FOR THE RED COLLAR
THE SYMBOL OF SECURITY

It is threadless and permanently elastic. Every bolt—*regardless of commercial tolerances*—impresses (does not cut) its full thread contact in the Red Elastic Collar to fully grip the bolt threads. In addition, this threading action properly seats the metal threads—and eliminates all axial play between bolt and nut threads.

All ESNA Elastic Stop Nuts *—regardless of size or type—* lock in position anywhere on a bolt or stud. Vibration, impact or stress reversal cannot disturb prestressed or positioned settings.

ESNA **ELASTIC STOP NUTS**

INTERNAL WRENCHING · ANCHOR · INSTRUMENT MOUNTING · SPLINE · CLINCH · GANG CHANNEL

PRODUCTS OF: ELASTIC STOP NUT CORPORATION OF AMERICA

Rolling Steel DOORS

Manual • Mechanical • Power Operation

In Mahon Rolling Steel Doors, Grilles and Shutters you get the ultimate in modern design, materials and workmanship. The Mahon Standard Power Operator in particular offers advantages in operation and in compactness of design which are not available to you elsewhere. You will find also that there is a Mahon Rolling Steel Door, Grille or Shutter to meet perfectly every commercial or industrial requirement. See Mahon Insert in Sweet's, or consult a Mahon Engineer.

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Manufacturers of Rolling Steel Doors, Shutters and Grilles, and Mahon Steel Deck for Roofs, Sidewalls, Partitions, Acoustical Ceilings, Permanent Floor Forms and Oversize Doors.

NEW CATALOG NOW AVAILABLE

Complete Catalog, containing Installation Details and Clearance Dimensions, will be mailed upon request.

ROLLING STEEL DOORS, SHUTTERS AND GRILLES TO MEET EVERY REQUIREMENT

One of Many Mahon Power Operated Rolling Steel Doors Installed in the New Plant of The Falls Spring & Wire Company, Detroit, Mich.

MAHON

Manufacturers' Activities

ARLINGTON W. CLARK, Toronto, has been appointed general manager of Snap-on Tools of Canada, Ltd. Mr. Clark has served since 1934 as managing director of Black & Decker Manufacturing Co., Ltd. In his new position he will be in charge of all sales, production and administrative functions of the home office and factory at Long Branch, Ont., and will direct product distribution to Snap-on's six Canadian warehouses.

INTERNATIONAL HARVESTER CO. has a new $45 million plant in Louisville, Ky., bought from the War Assets Administration. It is expected that at full capacity, next fall, the plant will turn out 109,000 tractors annually.

DESOTO FOUNDRY, INC., Mansfield, La., will change its name, effective November 1, 1946, to Hendrix Manufacturing Co., Inc.

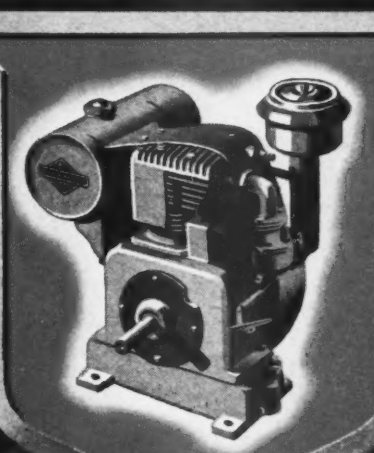
W. W. HURLBUT of Los Angeles, Calif., and Miss Hazel V. Dennis of Baltimore, Md., were the first-prize winners of $500 in the 100 percent metering contests sponsored by the Pittsburg Equitable Meter Division of Rockwell Manufacturing Co., Pittsburgh, Pa. These contests were designed to stimulate public thinking on the community advantages of 100 percent water metering.

THE DIAMOND WIRE & CABLE CO. has purchased the surplus manufacturing plant in Sycamore, Ill operated during the war period by the Anaconda Wire and Cable Co. The plant will produce building material and wire needed in the present housing emergency and will employ 125 workers.

L. A. PETERSON, president of the Otis Elevator Co., New York, has announced the election of Percy L. Douglas and of Bruce H. Wallace as vice presidents. Mr. Douglas will continue in charge of the company's foreign operations and Mr. Wallace will have general responsibility for all accounts and budgets. L. W. Whitton has been appointed manager of operations and C. C. Campbell general works manager.

Foundation work is under way for the new plant which The Foxboro Co.,

Equipment Performance Depends on the Engine that Powers It!



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BRIGGS & STRATTON

Engines are "Tops" in Demand

There are over 2½ million reasons for today's unprecedented demands for Briggs & Stratton powered equipment. They are the more than 2½ million Briggs & Stratton engines built during the past 26 years. These engines have established an unbeatable record for instant starting, long life, dependable operation, and maximum performance with a minimum of servicing. No wonder these stout-hearted, precision-built engines rate "tops" as the *power choice* of equipment users, dealers and manufacturers everywhere! And here's good news! Deliveries are improving with our stepped-up production. It will pay you to wait until you can have equipment that's powered RIGHT by — Briggs & Stratton air-cooled engines — the world's finest.

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Air-Cooled Power

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BRIGGS & STRATTON
GASOLINE ENGINES

"I haven't been off the job with a cold since they gave us . . .

VORTEX CUPS"

Single-use paper cups have doomed the commonly-mouthed dipper and water bucket. Dixie's Portable Water Carrier, with individual Dixie or Vortex Cups, guards against the spread of mouth-carried diseases. Reduces sick absenteeism . . . saves time wasted going for water. Let it help keep your men steadily on the job. *Write for descriptive booklet.*

DIXIE'S PORTABLE WATER CARRIER

EFFICIENCY HINT: The more nearly water intake offsets sweat loss by men doing manual labor, the better their performance, as shown in report by Harvard University Fatigue Laboratory. Free copy on request.

DIXIE CUPS, VORTEX CUPS AND PAC-KUP CONTAINERS ARE MADE AT EASTON, PA., CHICAGO, ILL., DARLINGTON, S. C., TORONTO, CANADA

Ltd., is erecting on a 3½-acre site in the Ville LaSalle section of Montreal. The completed building will be turned over to the owners in the spring of 1947, ready for immediate occupancy. The brick and steel plant will consolidate machining, metal finishing and other basic operations, and assembly and calibration of instruments, on one floor level.

H. M. ALEXANDER, manager of the sales technical service department of Libbey-Owens-Ford Glass Co., Toledo, Ohio has been named assistant to George P. MacNichol, Jr., vice president in charge of sales, succeeding the late North A. Wright. The position will include supervision of the product promotion department and liaison work between sales and manufacturing departments, as well as management of the sales technical service department.

JOHN LESTER PERRY, who rose from a steel plant clerk to the presidency of Carnegie-Illinois Steel Corp., retired recently as head of this U. S. Steel subsidiary and becomes assistant to the president of United States Steel Corp. of Delaware, Benjamin F. Fairless. Mr. Perry, a native of Worcester, Mass., began his business career as a cost clerk in the Worcester operations of American Steel and Wire Co., on his graduation from high school in 1899; he was transferred to the operating end of the industry as a foreman of the cold rolling department in 1913. From then on he rose through the position of assistant superintendent and superintendent becoming manager of the company's Worcester district in 1928. He was appointed vice president of the company in charge of operations in 1933, with headquarters in Cleveland, O. Two years later Mr. Perry was elevated to the presidency of Tennessee Coal, Iron and Railroad Co., of Birmingham, Ala., another U. S. Steel subsidiary. On Jan. 1, 1938, he became president of Carnegie-Illinois Steel Corp., with headquarters in Pittsburgh.

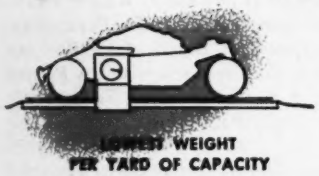
FARNES AND MARTIG, INC., have been appointed sales and service representatives for the state of Oregon for the Wheelco Instruments Co., Chicago, Ill.

W. B. ELLIOTT, president of the Insley Manufacturing Corp., Indianapolis, Ind., has announced the appointment of L. C. Gerow as manager of the company's parts and field service department, succeeding the late Charles A. Menefee.

MARQUETTE CEMENT MANUFACTURING Co. has announced its first major post-war plant reconstruction project in the modernization of the storage and ship-

LOAD... haul ...DUMP...SPREAD

you're yards ahead with *the new* LPC *Carrimor**



LOWEST WEIGHT PER YARD OF CAPACITY

PROPER WEIGHT DISTRIBUTION

LOW HORSEPOWER REQUIREMENTS

Once you get a load into a scraper, it's important to get it rolling to the dump—and back again—as quickly as possible. Here again, you'll earn more with a "Carrimor" because it has less dead weight per yard of capacity than any other scraper on the market. This, together with proper weight distribution, reduces horsepower requirements and fuel costs, saves wear and tear on your tractor and enables you to handle peak pay loads with maximum efficiency.

Low center of gravity, low draft and low overall height also mean that the new LPC "Carrimor" trails easier, has greater stability and can be operated anywhere without worrying about overhead clearance. Moreover, the choice of single, over-size single or dual tires assures efficient results under all working conditions. Get the facts and you'll get an LPC—for lowest possible cost per yard. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; Oakland, Calif.

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Job-Proved Equipment... for Lowest Possible Cost in Moving Earth

All that the law will allow

For profitable operations . . . for "time-saving" trips . . . truckers everywhere are going to heavier loads . . . peak capacities . . . as much weight as the law will allow.

Regardless of the loads you haul, or the roads you travel, the correct combination of engine, axle, transmission and other assemblies is necessary to keep your operating and maintenance costs down . . . *to increase your profits.* That's why truckers everywhere are *specifying Fuller Transmissions* . . . the transmission designed and built for their "balanced rigs" . . . the "geared-to-the-job" transmission that will do their particular job best.

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KALAMAZOO 13F, MICHIGAN
Unit Drop Forge Division, Milwaukee 1, Wisconsin

Fuller TRANSMISSIONS

AL BRUMLEY and FRED STUART *AREN'T SPEAKING!*

They're too busy getting ready for the revolutionary water coagulator which you'll be using come fall. And, at the same time, they're still keeping up the high standard of service which you've come to expect of Stuart-Brumley when you order Activated Alum, Blackalum, Palmer Filter Bed Agitators, and the amazing new Automatic Water Sampler. (Electric . . . takes samples 24-hours a day . . . keeps accurate check on bacterial count . . . needs no operator)

SO . . . .

Order Now From

STUART-BRUMLEY CORP., 516 N. Charles St., Baltimore 1, Md.

STUART – BRUMLEY

ping departments at its Hawkeye plant in Des Moines, Iowa, where new storage silos, packing and bulk loading plants and a sack handling plant will be constructed.

JOSEPH W. SARGENT, formerly manager of the Eastern region of Worthington Pump and Machinery Corp. construction equipment division, has accepted the position of manager of Construction Equipment Sales for the American Air Compressor Corp., 48th Street & Dell Avenue, North Bergen, N. J.

CONSTRUCTION HAS BEEN STARTED on another unit in the plant expansion program of The Heil Co. This $500,000 addition to Plant 3 at Milwaukee will add over 110,000 sq.ft. of manufacturing space to its 52-acre layout. Addition of the wing will give a straight-line production area over ⅓-mi. long with rail facilities through its entire length. Another 30,000 sq. ft. building is under construction at Hillside, N. J., and a three-story sales office building has been completed at Plant 1, Milwaukee.

WILLARD M. BROXHAM has been named manager of sales for the fabricated plate division of the Graver Tank & Mfg. Co., Inc., with headquarters at the general offices in East Chicago, Ind.

THE CLAY SEWER PIPE ASSOCIATION, INC., announces the addition to its technical staff of Edward A. Walker who has been connected with the Pennsylvania Department of Health since 1937, and prior to that time was with the Pennsylvania R.R. Co. and John F. Casey Co., Pittsburgh, Pa.

THE BARIUM STEEL CORP. announces the acquisition of 100 percent control of the Wiley Equipment Co. of Port Deposit, Md., and the Wiley Manufacturing Co. of Mountville, Pa., manufacturers and fabricators of cranes, barges, hoisting and loading equipment. The operations of both companies will be coordinated with and supplement the activities of the Clyde Iron Works, Duluth, Minn., a subsidiary of the Barium Steel Corp.

THE CELOTEX CORP. of Chicago has acquired The Weaver-Wall Co. of Cleveland, Ohio, manufacturers of asphalt shingles, roofing and siding products. Acquisition of this company is part of an expansion program in which Celotex plans to increase production of building materials.

Appointment of FRED S. CRESSWELL as manager of National Clay Pipe Manufacturers, Inc., with offices in Washington, D. C., has been announced by NCPMI officials.

Manufacturers' Publications

Dry Back Boilers—An illustrated, 12-p. booklet, "Scotch Dry Back Boilers," is now available in four languages. It gives considerable descriptive and operational information about this type of equipment.—*Dominion Bridge Co., Ltd., Lachine, Que., Canada.*

Color Conditioning — "Du Pont Color Conditioning for Industry," a new 32-p. booklet in full color, illustrates and describes research and practical experience with color to increase production, improve seeing conditions and create a better working environment. It makes clear the fundamental principles on which color conditioning is based. The "Three-Dimensional Seeing" treatment of machines is depicted with photographs of actual installations and the safety color code for industry is outlined. Color conditioning is shown at work in plants of several well-known companies. A coordinated functional color program for an entire plant is illustrated in a double-page cutaway drawing.—*Finishes Division, E. I. du-Pont de Nemours & Co., Inc., Dept. M-6, Wilmington 98, Del.*

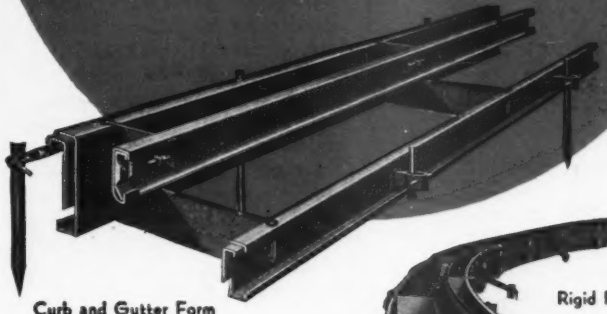
Double-Pass Firebox Boilers—A new bulletin, No. RM-1, illustrates the line of riveted or welded double-pass steel firebox boilers that are built especially for stoker, oil, or gas firing. They range in capacity from 26 to 305 hp., in three series.—*The Brownell Co., 426 Findlay St., Dayton 1, Ohio.*

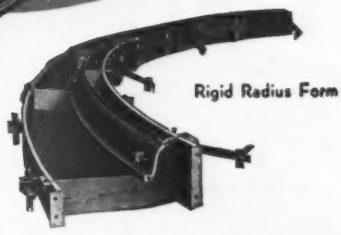
Concrete Maintenance — Concrete maintenance is the timely and important subject of the current issue of The Trowel. Discussing the causes of concrete disintegration and how to make successful repairs, this 12-p. bulletin contains practical information on bridge maintenance, increasing the useful life of concrete floors by "armorplating," controlling the shrinkage in machinery grouts, building restoration, repairing hydraulic structures, repairing railroad structures, waterproofing grain elevators and sewage treatment plants, and protective sealing and decorating concrete and masonry surfaces. Much information is presented pictorially also.

Shrinkage of Concrete and Mortar—Shrinkage of concrete and mortar—its important influence on durability and serviceability, the principal factors affecting it, and its control and elimination—are discussed in a 34-p. booklet,

Heltzel
BUILDS IT BETTER

FORMING and HANDLING Equipment FOR ALL CONCRETE PROJECTS





● Try Heltzel steel forms, and you'll discover why they give dependable service for 20 years or more. The value of your Heltzel forms increases with each additional mile of paving, and you'll find that each job you set is as uniform as the ones before. The low cost of equipment per year of service plus reduced maintenance and conditioning costs, effect substantial savings. Write today for copies of the Heltzel catalogs.

BINS, Portable and Stationary
CEMENT BINS, Portable and Stationary
CENTRAL MIXING PLANTS
BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)
BITUMINOUS PAVING FORMS
ROAD FORMS (with lip curb and integral curb attachments)
CURB FORMS
CURB AND GUTTER FORMS
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CONCRETE BUCKETS
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FINISHING TOOLS FOR CONCRETE ROADS

HELTZEL STEEL FORM & IRON CO.
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fingers rejoice in discovering in MICROTOMIC "VAN DYKE" the assurance of uniformity in grading on which a draftsman depends for true pencil satisfaction. Assurance born only from trial and conviction. Try Van Dyke Drawing Pencils in your favored degrees—you'll marvel at their exactness.

Your choice of 18 Degrees from 7B to 9H with Round Leads.. plus 6 Degrees with special Chisel Point Leads.

"The Action of Embeco in Concrete and Mortars." Explaining the principle of specially prepared metallic aggregate in controlling shrinkage, this booklet features charts, graphs and useful technical data which add to its practical value.—*The Master Builders Co., Cleveland 3, Ohio.*

Remote Indicating and Control Systems—A 12-p. engineering bulletin, 14B6641, tells how the transmitter, receiver and indicator of remote indicating and control systems are constructed, how they work; their important advantages and specifications are graphically presented with photos, diagrams and charts.—*Allis-Chalmers Mfg. Co. 686, Milwaukee 1, Wis.*

Blowers and Exhausters—Bulletin 120-B-13, covering centrifugal blowers and exhausters, is an 8-p. folder in two colors stressing the wide range of applications where R-C centrifugals have been, or may be, used, and including blast furnaces, coke ovens, oil refineries, chemical plants, sewage disposal works, large capacity vacuum service, and many others. It is stated that these units are equally effective as boosters or as exhausters, and an instance is cited where gas at 1,000 deg. F. has been successfully circulated at 100-lb. pressure. — *Roots-Connersville Blower Corp., Connersville, Ind.*

Open Steel Flooring—A 40-p. catalog on open steel flooring for bridges contains the latest engineering information on the design and selection of grating and stringers in accordance with the 1944 standard specifications of highway bridges of the American Association of State Highway Officials. It concisely explains the increasing importance, usefulness and benefits of this type of bridge flooring, and fully describes the various Kerlow designs and their applications for open flooring and filled slabs, with dimension charts, complete specifications, selection and installation data for each design. Also included in the illustrated catalog are descriptions and detailed data on Kerlow splices, drain grates, trench grates, expansion joints, sidewalks, safety steps, and industrial applications of Kerlow gratings for platforms, structures, floors, walkways, stairways, etc. —*Kerlow Steel Flooring Company, 222 Culver Ave., Jersey City 5, N. J.*

Automatic Flow Responsive Equipment and Methods—Bulletin No. 1200 is a handy reference book and contains material dealing with automatic flow responsive equipment and methods in continuous process operation. Photographs of chemical proportioning equipment and typical installations are supplemented by many flow diagrams and detail drawings. The Proportioneers method is clearly explained and the operation of the equipment is demonstrated by two-color diagrams. The catalog permits the purchaser to select and size equipment for most treating, sampling, blending, and diluting applications. — *Proportioneers, Inc., Providence 1, R. I.*

Diesel Tractors — (24-p. catalog) Introduces newly improved HD-10 diesel tractor. Among features in this booklet are those about grease-packing and "positive seals", transmission construction, two-cycle diesel power, new longer track design. Entire page is devoted to standard equipment and auxiliary attachments of the HD-10. Specification sheet offers detailed information about tractor's 86-drawbar horsepower, its six speeds forward and two reverse, engine dimensions and fuel capacities.—*Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee 1, Wis.*

Fire Protection — (20-p. booklet) Explains and illustrates latest techniques in fighting fires with carbon dioxide and other types of fire extinguishers. Entitled "How to Fight Fires and Protect Property", it contains many photographs and diagrams.—*Randolph Laboratories, 8 E. Kinzie St., Chicago 11, Ill.*

Estimating Guide Folder — (4 pp., illustrated) Provides architects, engineers and general contractors with practical estimating data on building construction materials. It is standard file cabinet size and, being in chart form, may be conveniently kept under glass top of estimator's desk, as well as in file cabinet itself. It presents quick-reference estimating data on concrete and wood floor treatment, concrete and mortar admixtures, waterproofing and dampproofing, and roof coatings. Quantities required and abbreviated directions are also listed, as are A.I.A. File numbers and other reference sources.—*Building Products Division, L. Sonneborn Sons., Inc., 88 Lexington Ave., New York 16, N. Y.*

Hydraulic Brake — (22-p. service manual) Includes general service instructions and maintenance suggestions for new Wagner Lockheed self-centering self-adjusting hydraulic brake. Drawings and sketches are used to illustrate operating principle of self-centering feature; self-adjusting device which automatically compensates for lining wear; and complete servicing procedure, including shoe removal relining, inspection of self-adjusting device, brake assembly and initial adjustment, reassembly of self-adjusting device,

Service records of owners prove the

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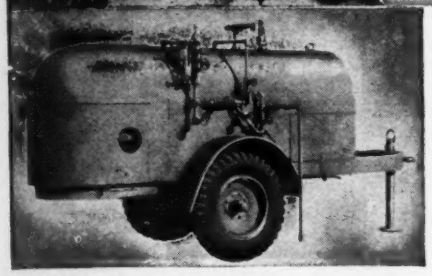
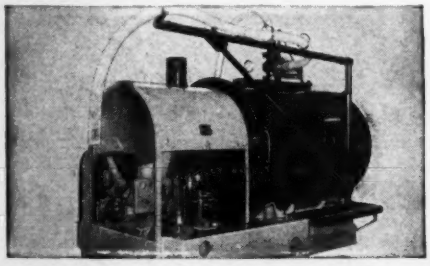
Bituminous Heating Equipment



Mobile tank-car heater available in two and three tank-car sizes. Oil-fired with exclusive design four-pass flue travel; dry-coil steam condensate return under pressure—no water or heat loss.



Portable pumping booster. Heats by direct firing in one operation, loading directly to distributor, relay truck or returning to tank-car. Available in 2 sizes—truck mounting or 4 wheel trailer.

Truck mounted pumping booster in service of Oklahoma Bituminous Distributing Co., Ada, Okla.

★ Most of the pioneer models of tank-car heaters, built by Cleaver-Brooks sixteen years ago, are still in service.

★ There are more Cleaver-Brooks tank car heaters and bituminous boosters in service than all other makes of similar equipment combined.

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★ The design and construction of Cleaver-Brooks heating equipment is subject to constant check—to include every feature that contributes to the most effective performance and long service life.

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adjusting brake pedal, master cylinder, and parking brake, bleeding hydraulic system and servicing master cylinder and wheel cylinders.—*Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Miss.*

Waterproof Connector—(4-p. folder) Describes Type W connectors, which are designed specifically for submarine geophysical exploration and are also adaptable for use in swamps, lakes, rivers, docks, with underground cable, or in any outdoor applications where moisture conditions require a thoroughly sealed fitting.—*Cannon Electric Development Co., 3209 Humboldt St., Los Angeles 13, Calif.*

Expansion Joints — (12-p. catalog) Lists complete engineering data, dimensional tables and specifications for standard packless expansion joints, anchor joints and low-pressure, large-diameter expansion joints. It contains information on other recent developments, such as offset, Turbo and jacket joints, and includes material on high-temperature exhaust bellows and heavy-duty clinch-lock bellows.—*MagniLastic Division Cook Electric Co., 2700 Southport Ave., Chicago 14, Ill.*

Ladders — (4-p. folder) Emphasizes safe use of ladders and lists causes of ladder accidents on construction jobs. —*Loss Prevention Dept., Liberty Mutual Insurance Co., Boston, Mass.*

Lubrication of Diesel Engines — (52-p. technical bulletin) Contains sections on development of diesel engine; common types; explanation of combustion process; modern fuel injection system; accessories, their design and use; cylinder and bearing lubrication; lubricating oil recommendations; and filters, strainers and reclaimers.—*Sun Oil Co., Industrial Products Dept., Philadelphia 3, Pa.*

Mining Tools — (16-p. catalog) Introduces snap-button augers, plug drill bits, core drill bits, additional sizes in two- and three-way rotary drill bits, and expanded line of undercutter bits. It provides complete buying information, illustrates proper selection and application, and instructs on methods of use and maintenance to insure optimum performance. — *Kennemetal, Inc., Latrobe, Pa.*

Record, Indicating, Controlling Instruments — (4-p. bulletin) Illustrates and briefly describes shunt-flo meter, venturi tubes, flo-watch, propelflo meter, venturi insert nozzle, chronoflo telemeter, orifice plate and flanges, chronoflo control, manometers and flo-gage.—*Builders-Providence, Inc., Providence 1, R. I.*

Elections and Activities

For the first time since prewar days, the California section, American Water Works Association, recently held a meeting with exhibits by manufacture as well as technical sessions in San Francisco's civic auditorium. There was a registration of 850. There were parallel sessions for the purification and the plant management and operation divisions.

Resolutions included a recommendation for legislation requiring the certification of waterworks operators, the further study, on a state-wide basis, of pollution of underground water supplies, and a request for legislation to make possible use of state funds for moving utilities when necessitated by state highway work.

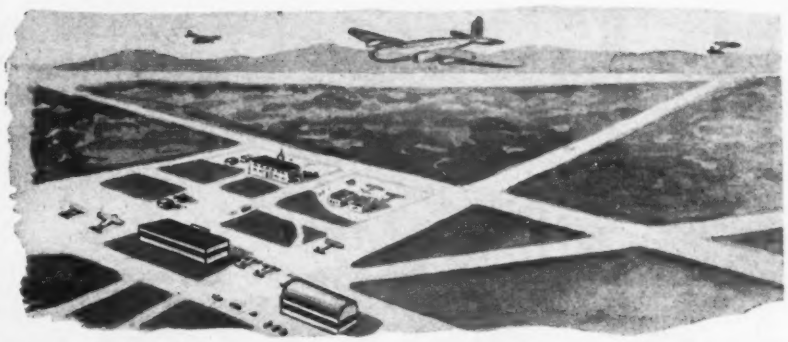
Officers elected are: President, R. C. Kennedy, assistant chief engineer and general manager, East Bay Municipal Utility District, Oakland; vice-chairman, H. Arthur Price, assistant specification engineer, Department of Water and Power, Los Angeles; secretary-treasurer, Ray L. Derby, assistant sanitary engineer, Department of Water and Power, Los Angeles.

Three new branches of the Engineering Institute of Canada have recently been formed, at Kootenay, B. C.; Sarnia, Ont.; and Cornwall, Ont. The Cornwall branch is the latest—the 28th. D. Ross-Ross is chairman of the new branch, and W. P. Nesbitt is secretary-treasurer.

The western division of the National Association of County Officials, meeting recently in Salt Lake City, Utah, voiced strong objections to state road commissions' policies of constructing county roads on a contract basis. It was pointed out that most counties are financially unable to match federal appropriations when state officials insist on using the contract method. It was suggested that state commissions be forced to conform to the spirit of the law as intended when Congress appropriated $450,000,000 for the postwar county road program.

Delegates to the one-day session were from Arizona, Colorado, California, Idaho, Oregon, Utah and Wyoming.

The University of Mississippi student chapter of the American Association of Civil Engineers has elected these officers: George J. Littleton, president;



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Ralph Bradley, vice-president; Smith Beard, secretary; Thomas J. Adams, treasurer; and Ralph Gerard, program chairman.

New officers for the New England Sewage Association are: President, Thomas R. Camp, Boston, Mass.; 1st vice-president, LeRoy W. Van Kleeck, Hartford, Conn.; 2nd vice-president, Walter H. Brown, Jr., Cranston, R. I.; Directors, Engene L. Bond, Greenfield, Mass.; Joseph Dorman, Greenwich, Conn.; William S. Wise, Hartford, Conn.; secretary-treasurer, Walter E. Merrill, Boston, Mass.

New officers of the Georgia Water and Sewage Association are: President, Comer Turley, Lindale; 1st vice-president, B. L. Coburn, Fitzgerald; 2nd vice-president, D. H. Hurst, Tifton; secretary-treasurer, Van P. Enloe, Atlanta; assistant secretary-treasurer, L. E. Waller, Atlanta; director, 1st District, V. D. Parrott, Jr., Dalton; director, 3rd district, B. J. Cash, Newnan.

Officers of the United Engineering Trustees, Inc., are: J. P. H. Perry, president; Ralph M. Roosevelt and Gen. Wm. H. Harrison, vice-presidents; Albert Roberts, treasurer; C. R. Jones, assistant treasurer; and John H. R. Arms, secretary.

The following new officers were installed at the recent annual meeting of the Washington, D. C., Building Congress: President, A. W. Lee, president of A. W. Lee, Inc., plastering contractors, vice-presidents, John G. Scharf, president of Prescott Construction Co., general contractors, Louis Justement, architect, and P. Y. K. Howat, president of Howat Concrete Co., ready mixed concrete; secretary, John S. MacBryde, Abco Supply Co., building materials; treasurer, W. A. H. Church, W. T. Galliher & Bro., Inc., lumber and millwork; counsel, Earl Whittier Shinn of McCawley, Shinn & Grimes. Mr. Lee succeeds Charles T. Penn, vice-president of Indiana Limestone Corp., Mr. Scharf and Mr. Justement were vice-presidents of the Building Congress last year. Mr. MacBryde succeeds M. S. MacKinnon, Super Concrete Co., as secretary.

Mr. Lee has appointed the following on the board of governors for the coming year: A. T. Abernethy, F. G. Addison, Jr., J. M. Baker, Norman H. Barnes, Miles L. Colean, Robert H. Davis, Walter G. Distler, James B. Edmunds, F. Stuart Fitzpatrick, Howard P. Foley, M. F. Hoppe, Frank R. Howard, H. Peyton Howard, Jr., H. A. Johns, William G. Jones, Jr., Karl F. Jorss, M. C. MacKinnon, L. Ourusoff, Charles T. Penn, C. F. Preller, and W. E. Reynolds.

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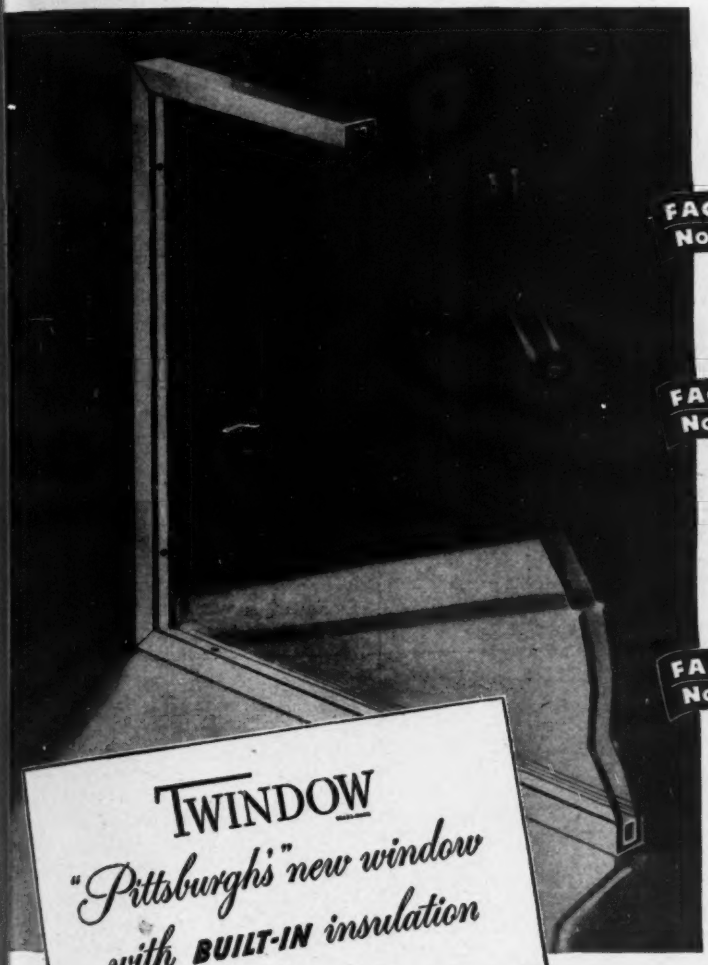
TRADE-MARK



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Twindow with two panes of glass has more than twice the insulating efficiency of ordinary windows. With three or more panes, the insulating efficiency is still further increased. This saves money by reducing the load on heating and air-conditioning equipment. It not only saves fuel . . . it makes practical more and larger windows so that rooms can be flooded with natural daylight. More use of daylight will cut lighting bills.

FACT No. 3

Twindow makes any building more comfortable and more healthful

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FACT No. 4

Twindow is designed to prevent fogging or condensation on the glass

Except under extreme conditions, its sealed-in air space assures window transparency in any climate. This makes Twindow a "must" wherever clear vision is important . . . picture windows for homes, store front display windows, large windows in office buildings, factories, and institutions.

FACT No. 5

Twindow can be handled, installed and cleaned as simply as a single pane of glass

It is a one-piece window unit, completely prefabricated.

We regret that current production is not meeting demands. Deliveries must continue slow until new facilities are completed. When planning new construction or modernization, we suggest you get in touch with our nearest branch to determine if our delivery schedule will permit your use of this finest of insulated windows.

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S. R. P. is easy to apply—needs no expensive preparation—goes on like paint—and you don't have to remove firm rust. S. R. P. penetrates through and combines with existing rust to bond firmly with clean metal, forming an impermeable coating against air as well as moisture. Its exceptional elasticity prevents formation of pinholes and resists the damaging effects of expansion and contraction.

Protect piping, fences, structural members and sheet metal surfaces with S. R. P. #75 Primer; then, as a finish, apply either S. R. P. #87 or SONOLASTIC Aluminum *Ready-Mixed.*

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Men and Jobs

Appointment of **Lieut. Col. Sam G. Neff,** Corps of Engineers, of Cody, Wyo., as chief of the construction division of the District Army Engineers Office has been announced in Denver by Col. Craig Smyer, district engineer.

Lieut. Col. Neff was graduated from the University of Wyoming in 1922. From 1928 to 1933 he was in charge of field work on water research surveys of the Missouri River for the Army Engineers. In 1933 he was assigned assistant superintendent of construction at Fort Peck Dam where he remained until 1938 when he was appointed chief of operations during the construction of Dennison Dam, Texas. In 1940 he was assigned to Newfoundland where he was in charge of construction of airfields, Army bases, and fortifications. In May, 1942, he was commissioned major in the Corps of Engineers. In 1943 he was appointed Operations Officer in the New England Division, Boston, Mass. In 1944 he was appointed district engineer in Providence, R. I. Later in the same year he was appointed district engineer in the Kansas City District, Kansas City, Mo. In March, 1946, he was awarded the Legion of Merit.

Robert Cooper, formerly with the New York district office of the U. S. Engineer Department, has been appointed city engineer of Rice Lake, Wis.

Capt. Thomas H. Urdahl, USNR, and Comdr. John Everetts, Jr., USNR, recently released to inactive duty by the Navy, have joined forces as consulting engineers, specializing in problems of air conditioning, industrial drying and dehumidification. Offices have been opened at 212 Madison Street, San Francisco 5, Calif., under the resident direction of John Everetts, Jr., and a temporary office at 726 Jackson Place, N.W., Washington 6, D. C., under resident direction of T. H. Urdahl.

Col. A. W. Howson, recently returned from 33 months service in the Pacific and for many years engineer for the Illinois Central Railroad, has joined the staff of Alvord, Burdick and Howson, Chicago engineers. During his military service he commanded the

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1521st Engineer Construction Group on Saipan and the 1497th Engineer Port Construction and Repair Group on Okinawa. Naha Harbor was rebuilt and much of the construction on Southern Okinawa was performed under his command. He is a graduate of the University of Illinois.

George E. Tomlinson has left the Tennessee Valley Authority to become assistant director of the branch of project planning of the U. S. Bureau of Reclamation. Formerly an assistant professor of civil engineering at the University of Tennessee, Mr. Tomlinson has been with TVA since 1935, taking leave to serve with the Marine Corps Engineers where he rose to the rank of colonel.

George T. Parkins, senior bridge designer of the North Carolina State Highway and Public Works Commission, Raleigh, N. C., who resigned on Aug. 7, to enter the service of W. C. Olsen, engineer, Raleigh, has returned to his former position with the commission.

Arthur Sidney Hicks, recently assistant engineer of The Mountain Water Supply Co., a subsidiary of the Pennsylvania Railroad Co., is now associated with Charles Haydock, consulting engineer, Philadelphia 2, Pa. He is a graduate civil engineer from Princeton University.

Ernest E. Carpenter, Bloomfield, Conn., has been appointed a member of the Metropolitan District Commission, Hartford, Conn., to succeed George J. Mead, resigned. Mr. Carpenter will hold a membership on the Bureau of Public Works and complete the term of Mr. Mead.

Harry A. Reed has been elected vice-president of Day & Zimmerman, Inc., Philadelphia, Pa., and will coordinate new business activities. **Thomas W. Hopper** will succeed Mr. Reed as engineering manager and will have charge of design and engineering for the construction department.

W. E. Uren, at present priorities officer, has been appointed coordinator of building materials and will head the building materials branch of the Canadian department of reconstruction and supply. The post of coordinator of housing is abolished. T. F. Flahiff, who has been holding that post in addition to his duties as timber controller will continue in the latter capacity.

Walter A. Taylor who holds degrees in engineering from Ohio State University and in architecture from Colum-

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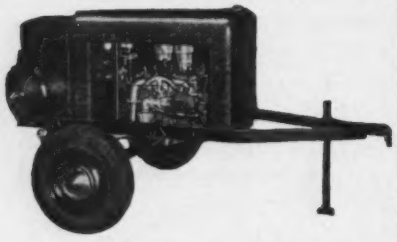

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bia University, and who has been associate professor of architecture at Syracuse University, has been appointed director of the new department of education and research of the American Institute of Architects.

William Freeman and **C. C. Tilley** of High Point, N. C., have formed William F. Freeman Engineers, Inc., a general construction and engineering business.

William K. Greene, for the last 17 years designing engineer in the New York office of the American Bridge Co., has been appointed assistant division engineer of the Chicago district. He succeeds **T. A. Jordan** who retired Nov. 1 after 36 years' service. Mr. Greene has been with the company since 1922 when he was graduated in civil engineering from Iowa State College. Before going to New York, he was in the company's engineering offices at Gary, Ind.

Mr. Jordan received his B.S. of C.E. degree from Michigan State College in 1910. Following graduation, he was employed for nine years in the company's Lassig plant, after which he was transferred to the Chicago office. Advancing through several positions, he was made assistant division engineer in 1941.

George B. Seeley is now chief of the liquid fuels and gas unit, Construction Branch, Headquarters, Army Air Forces, following five and a half years as chief of the liquid fuels section, Office of the Chief of Engineers, Washington, D. C. Prior to Jan. 1, 1941, he spent ten years in various U. S. district engineer offices in charge of structural design for various navigation locks on the Tennessee, Mississippi and Illinois rivers.

Maj. John S. Bethel of Wakefield, Mass., has been awarded the Army Commendation Ribbon for "outstanding meritorious performance of duties during the period of July 1, 1944, to Dec. 31, 1945, as assistant engineer of branch and chief of the sanitized section, utilities branch, Office Service Command. Major Bethel, now a member of the active reserve, operated during the war in the New York, New Jersey and Delaware areas as a member of the Army Engineers. He is a sanitary engineer with the Metcalf & Eddy Co., Boston, Mass.

Norman C. Stewart, civil engineer and a graduate of University of Toronto, has been named surveyor general, Department of Lands and Forests, British Columbia, succeeding F. C. Green.

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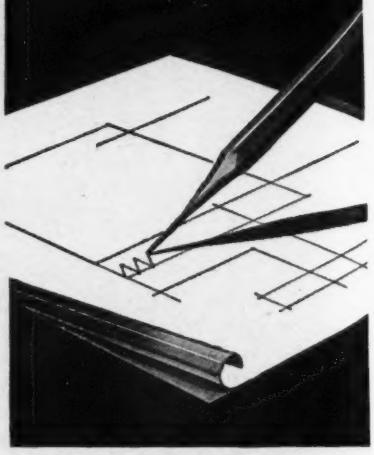

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Engineering School News

The present enrollment of the Georgia School of Technology, Atlanta, has reached 5,500, compared to a normal capacity of only 2,500. The overflow is accommodated by holding classes from 7 A.M. to 10 P.M.

In order to handle the expected 5,000 or more undergraduate students, the school has listed 12 vital construction projects to cost $8,790,000. These are: Classroom building for departments of mathematics, English and economics, $1,500,000; new textile building, $750,000; architectural buildings $625,000; library, $1,000,000; addition to research building, $500,000; chemical engineering building, $675,000; administration building and memorial hall, $800,000; auditorium and physical training building, $900,000; infirmary, $600,000; student activities building, $1,000,000; addition to aeronautical building, $350,000; and president's home, $90,000.

Tech hopes to be in its new dormitories and apartments by September, 1947. The three dormitories, of English collegiate Gothic, will finish out a block which already contains five such structures. The new ones will house 930 students, or about as many as the five old ones.

Dr. Robert I. Sarbacher, dean of graduate studies at the school, reports that his division is scheduling 357 courses leading to master of science and doctorate degrees.

In order to assist qualified graduate students who might be unable to continue their advanced education because of cost, Georgia Tech has available financial aids from $600 to $1800 per academic year. These include assistantships, instructorships and fellowships.

One of the recently established divisions at Cornell University is that of engineering physics to prepare students in a combination of engineering principles, applied physics, and mathematics for careers in research and development. It is expected to help bridge the gap between training in basic science and fundamental engineering. The degree of bachelor of science in engineering physics will be awarded to those who successfully complete the 5-year undergraduate curriculum.

In a report on veterans in California junior colleges, it was revealed that engineering is the leading veteran educational interest. According to Robert W. Webb and Byron H. Atkinson, who compiled the report, this situation is

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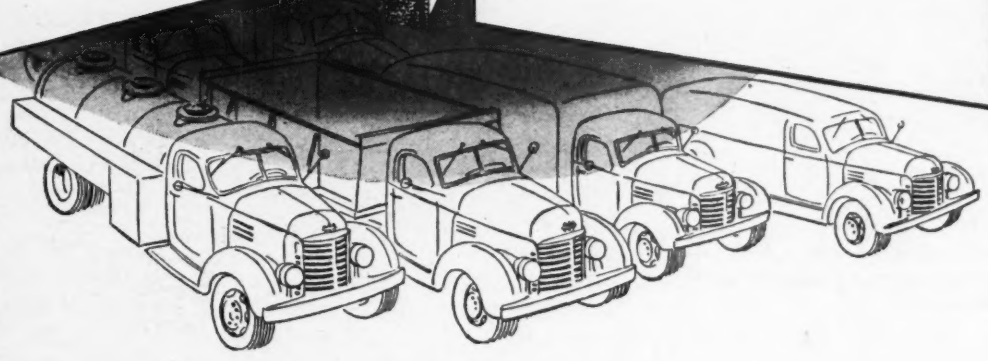

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the result of wartime prestige of all technical fields which is carrying over into the postwar educational pattern. Business and radio were second and third, with teaching, medicine and other service occupations far down on the list.

California Institute of Technology at Pasadena has received approval from the Federal Works Administration for a building for general classrooms, a drafting room building, and a structure for a research laboratory. The institute will receive structures to be dismantled at Camp Shoemaker and Camp Cooke, Calif., to meet the housing needs of a student body of 1,400 of whom 1,100 are veterans.

John C. Kohl has been appointed assistant professor of civil engineering at the University of Michigan, to teach transportation engineering. Mr. Kohl was graduated from Michigan in 1929 and was first employed on the construction of the Cincinnati Union Terminal. From 1930 to 1937, he was instructor in civil engineering at Carnegie Institute of Technology and spent several summers with the Pennsylvania Railroad. During the next seven years he was development engineer and assistant director of the central development laboratory of the Pittsburgh Plate Glass Co., then laboratory director of the subsidiary Pittsburgh Corning Corp. In January, 1944, he was called to active duty as a lieutenant (jg) and later lieutenant in the U. S. Navy and served on the staff of the General Ordance School and in the research and development division of the Bureau of Ordnance.

The United States Public Health Service and the National Institute of Health have made available two research assistantships in sanitary engineering at Georgia Tech. President Blake R. Van Leer said that these will be offered to outstanding students with a bachelor's degree in civil, chemical or sanitary engineering from a college of recognized standing. Veterans receiving the assistantships will be eligible to receive also an educational allowance from the Veterans' Administration.

Ivan C. Crawford, dean, college of engineering, University of Michigan, speaking before a recent joint meeting of the Chicago Engineers Club and the Western Society of Engineers, declared that engineers will be in far greater demand than ever before as policy makers for industry. He predicted that more and more engineering colleges will adopt a 5-year undergraduate training course. But, he said, the present 4-year schedule also will be retained by those schools because the need for

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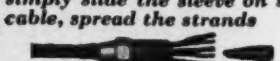
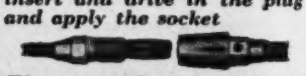


insert and drive in the plug and apply the socket



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THE STEEL FRAME GOES UP

MACOMBER ROOF DECKING

● This Steel Decking is either welded or clipped to the Roof Purlins. The ribs are expanded at the ends to fit over adjoining roof plates. Erection is fast and the finished job is both economical and durable. This decking is made in lengths up to 12 feet, 2 inches and comes painted, complete with all closure and finishing plates, as required.

THE STEEL DECK IS ATTACHED

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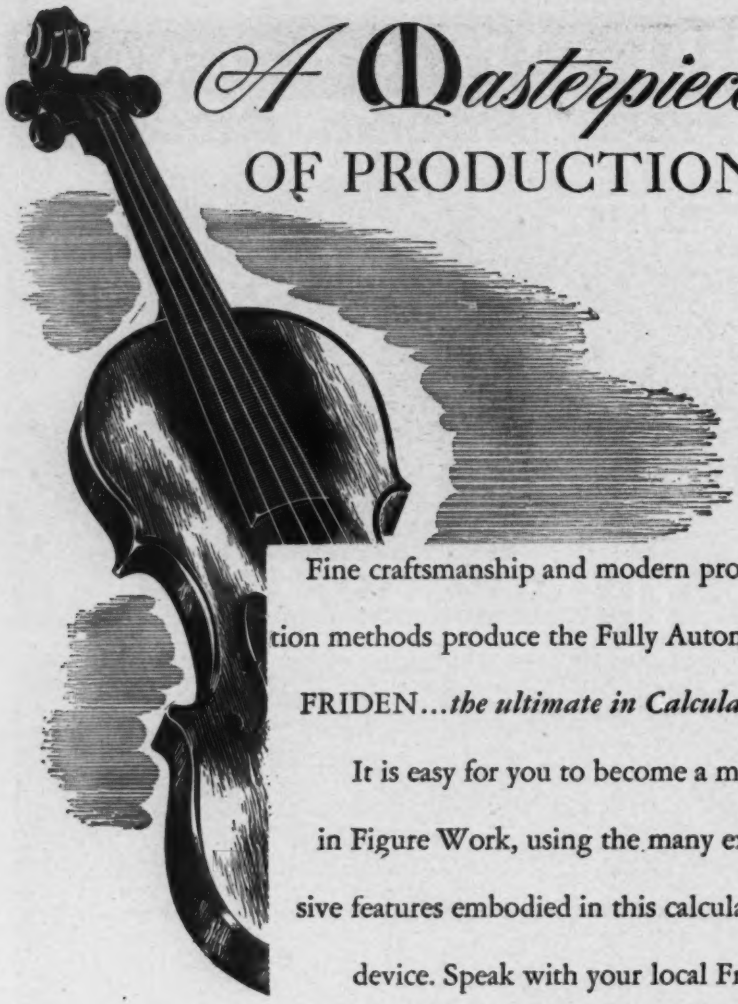

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engineers will be so great for many years to come that both industry, and public and private engineering will seek the services of 4-year college men, while engineers approaching the end of the 4-year course will become impatient to practice engineering.

David L. Arm, dean of the school of engineering, University of Delaware, has been named a member of the committee on undergraduate curricula of the American Society of Engineering Education. The appointment was made by President Huber O. Croft, of the society. The committee will study present trends and the requirements for engineering education.

Engineering faculty appointments at the University of Washington, Seattle, include that of Richard J. Cole as acting instructor in general engineering; Michael Guidon III, acting instructor in mechanical engineering; Albert L. Hoag, part-time acting associate in general engineering; Edgar M. Horwood, acting instructor in civil engineering; F. A. McMillan, research fellow in engineering; W. R. Mason, acting instructor in general engineering; J. L. Pendleton, acting instructor, civil engineering; C. M. Smith, research assistant, hydraulics laboratory; and John M. Wilson, research fellow, engineering experiment station.

Allan R. Cullimore, president of the Newark, N. J., College of Engineering, has been appointed an alumni council nominee for the visiting committee of the department of civil and sanitary engineering of the Massachusetts Institute of Technology. The committee functions as an advisory group.

L. K. Sillcox, Watertown, N. Y., has been appointed professorial lecturer on engineering at Purdue University, Lafayette, Ind.

The Small Homes Council of the University of Illinois has established a home research center. It will include a main building or demonstration center; production yards and shops; and research and experimental houses.

The major objective is the improvement of housing, with particular attention to the low-cost single family unit, or small home. The work will supplement and coordinate the specific investigations carried on by manufacturers and other research agencies, but duplication of work done elsewhere will be avoided. The center will not serve as a laboratory for testing materials or to endorse products, but special effort will be made to study the arts and sciences as they apply to housing and technological progress.

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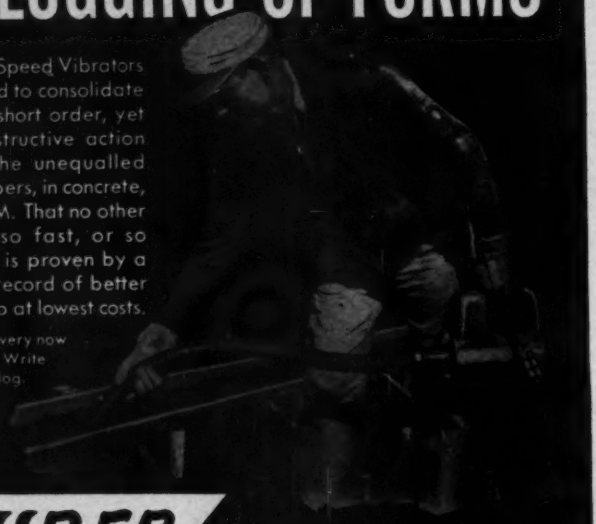

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Award money prizes in metering contest

The Pittsburgh Equitable Meter Division of the Rockwell Manufacturing Co. recently announced the award of prizes to contestants in a competition aimed at fostering universal metering of water.

Judges included J. H. Kennon, water commissioner of Pittsburgh, Pa.; Albert E. Paxton, publisher of *Engineering News-Record*, and William W. Brush, editor of *Water Works Engineering*.

Entries were split into two groups—one for the completion of a jingle about universal metering, and one which required an essay on the subject "How a Community is Benefited by Metering all Services." First prizes in the two groups went to Miss Hazel Dennis of Baltimore, Md., group 1, and W. W. Hurlbut, of Los Angeles, Calif., for group 2.

Onondaga Indians permit flood control

Charles H. Sells, New York State Superintendent of Public Works, has announced that agreements have been reached between the state and the council chiefs of the Onondaga Nation of Indians covering lands needed for the flood control project near Syracuse.

The agreement calls for construction of the flood protection dam project, with a flowage easement for a reservoir south of the dam and for an easement to relocate State Highway Route 11-A through the Onondaga Reservation.

The estimated cost of the entire project is $2,351,637 of which $1,754,860 will be paid by the federal government and $596,777 by the state.

Case Constr. Co. becomes Johnson Western Co.

Wm. A. Johnson, West Coast contractor, has acquired the interest of his former associate, Vern D. Case, in Case Construction Co., and the firm will be known as the Johnson Western Co. Mr. Case is withdrawing to devote his time to other interests.

Management of Johnson Western Co. will be in the hands of Elden Smith, president, and Harry Gast, vice-president and general manager. Mr. Smith recently resigned as vice-president of the Security-First National Bank of Los Angeles, Calif. Mr. Gast has been with Case Construction Co., since its inception in 1932 and its general manager since 1938. The key personnel and operating plant of the organization remain unchanged.